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INSECTS AND DISEASES OF VEGETABLES

IN THE

home garden



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Garden Bulletin No. 46.

Insects and Diseases of Vegetables in the Home Garden

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Agricultural Research Service*

This bulletin has been prepared for home gardeners. It tells how to recognize the more common insects and diseases that attack vegetables in continental United States, and how to prevent the damage they cause.

With few exceptions, the pesticides discussed for insect and disease control are readily available and have a wide range of use in the home garden. The dusts, granules, and baits come ready-mixed from dealers; the sprays are easy to prepare. If directions are followed, they are safe to use.

It is not possible to cover all aspects of the subject in a single bulletin. If this bulletin does not contain the answer to your garden pest-control problem, you can get information by writing to your county agricultural agent, to the agricultural college or department of agriculture in your State, or to the U.S. Department of Agriculture, Washington, D.C. 20250. Include your return address and ZIP code. If you cannot identify the insects or diseases that are damaging your plants, send specimens of the insects (in a small bottle of rubbing alcohol) or diseased parts of the plants to your county agricultural agent.



Use Pesticides Safely

FOLLOW THE LABEL

U.S. DEPARTMENT OF AGRICULTURE

Color photographs (pp. 33, 34) illustrating black rot of cabbage, bacterial blight of pea, and bean rust are by courtesy of the Wisconsin Agricultural Experiment Station; the one illustrating bacterial blight of bean is by courtesy of the Nebraska Agricultural Experiment Station.

¹ Retired.

INSECTICIDES AND FUNGICIDES

Insecticide Dusts and Sprays

You can use an insecticide as a dust or a spray. Dusts come ready to use; they require no mixing. They can be applied with less expensive equipment than that needed for sprays. Most sprays must be mixed by the home gardener. They are easier to control than dusts during application.

Follow safety precautions (p.7) when working with pesticides.

Do not apply an insecticide unless it is necessary to prevent damage to your vegetables. Very few of the insect pests in your garden will cause appreciable damage if you protect their predators and parasites by avoiding unnecessary applications of insecticides. (See "Beneficial Insects," p. 46.) However, if you do have a pest that usually causes serious damage unless an insecticide is used, apply the insecticide when the infestation first appears.

Watch for spider mites, cabbage caterpillars, the Colorado potato beetle, and the Mexican bean beetle; these are some of the insects likely to need prompt treatment with insecticides. Repeat the treatment in a week or 10 days if infestation continues. Do not treat for soil insects, such as cutworms, wireworms, and white grubs, unless they have caused damage or unless you find them when preparing the soil.

Dusts

Dusts recommended in this bulletin are available from pesticide dealers or garden supply stores. You may find it desirable to buy a dust containing a

fungicide (to kill disease organisms) and one or more insecticides (to kill insects). Such a preparation is very practical for garden use; it controls a larger variety of pests than a dust containing only one fungicide or insecticide. You may wish to obtain two or more dusts and fill each with a dust suited for a particular purpose.

Unless otherwise specified in this bulletin, purchase dusts that contain the following percentages of active ingredient:

	Percent
Carbaryl	4
Dicofol	2
Endosulfan	3
Malathion	4
Methoxychlor	5
Naled	4
Rotenone	$\frac{3}{4}$
Toxaphene	10

Apply an even, light coating of dust at the rate of 1 ounce per 50 feet of row or 125 square feet. Force it through the foliage so it reaches both sides of the leaves. Apply dust when the air is still.

Sprays

Few sprays come ready to use in the home vegetable garden. It is usually necessary to prepare sprays by mixing wettable powders or emulsifiable concentrates with water. These materials contain different percentages of active ingredient (different strengths).

The table below shows how to mix sprays in the strengths recommended in this bulletin. References to sprays are under "What to do" headings. "Insects and Diseases" section, starting on page 9.

The table gives proportions for mixing a small quantity of spray. If you require a larger quantity, use proportionately more of each ingredient in the mixture. If you use a material in which the *percentage of active ingredient* (strength) differs from that mentioned in the table, mix proportionately more or less of it with the water.

If you use a wettable powder, stir it vigorously in a small amount of water to make a smooth paste, or slurry. Add this to the full amount of water, and stir until completely mixed. When applying wettable-powder sprays, shake the applicator frequently to keep the powder from settling to the bottom of the spray chamber.

If you use an emulsifiable concentrate, shake the container thoroughly before measuring out the amount needed for the spray mixture. Apply 1 quart of spray per 50 feet of row or 125 square feet.

Insecticide spray formulations and mixing proportions

Insecticide	Formulation ¹	Amount of formulation to mix with 1 gallon of water
Carbaryl.....	50-percent WP.....	2 level tablespoons.
Chlordane.....	40-percent WP.....	1½ level tablespoons.
	or	
	45-percent EC.....	2 teaspoons.
Diazinon.....	25-percent EC.....	2 teaspoons.
Dicofol.....	18.5-percent WP.....	1 level tablespoon.
	or	
	18.5-percent EC.....	1 teaspoon.
Dimethoate.....	23.4-percent EC.....	1 teaspoon.
Endosulfan.....	50-percent WP.....	1 level tablespoon.
	or	
	2-pounds-per-gallon EC.....	2 teaspoons.
Malathion.....	57-percent EC.....	2 teaspoons.
Methoxychlor.....	50-percent WP.....	2 level tablespoons.
Naled.....	8-pounds-per-gallon EC.....	1 teaspoon.
Pyrethrum.....	Ready-prepared spray.....	(²).
Rotenone.....	Derris or cube root powder (5-percent rotenone content).	4 level tablespoons. ³
Sulfur.....	Wettable sulfur.....	3 level tablespoons.
Toxaphene.....	40-percent WP.....	3 level tablespoons.

¹ WP=wettable powder; EC=emulsifiable concentrate. If the available formulation contains more or less of the indicated active ingredient, mix proportionately more or less of the material with 1 gallon of water.

² Mix with water as directed on the container label.

³ First, mix the powder with a small quantity of water; then add remaining water.

Fungicide Dusts and Sprays

You can use a fungicide as a dust or a spray. Sprays are usually preferable for prevention of plant diseases in the home garden. Sprays stick to the plant surfaces better than dusts. They are most effective if applied with a compressed-air sprayer.

Fungicide dusts are effective if used properly. (See "Dusts," p. 2.)

For best results, apply a fungicide before there is evidence of plant damage. Repeat the treatment every week or 10 days. More frequent applications may be necessary during moist

weather, when plant diseases tend to be most severe.

Whether you use a dust or a spray, only those parts of the plant that are actually coated with the fungicide are protected.

Following is a discussion of the fungicides recommended in this bulletin, and a guide to the kinds of dusts and sprays to use. References to them are made under "What to do" headings in the Insects and Diseases section.

Copper Fungicides

The fixed copper compounds such as basic copper sulfate, copper oxychloride, and cuprous oxide are effective in preventing such plant diseases as late blight of potatoes and tomatoes, leaf blight of celery, and downy mildew of cucumbers and melons. These compounds are sold under various trade names; they should be used as directed on the container labels.

If you prefer a dust to a spray, use a fixed copper dust containing 5 to 7 percent of actual copper.

Organic Fungicides

Organic fungicides such as captan, ferbam, maneb, nabam, zineb, and ziram, are frequently used instead of copper fungicides. They are sold under various trade names, some of which are listed below:

Common name	Trade name
Captan	Captain 50-W, Orthocide 50 (Wettable).
Ferbam	Fermate, Karbam Black, Ferradow, Ferberk.
Maneb	Manzate, Dithane M-22.
Zineb	Dithane Z-78, Parzate Zineb Fungicide, Ortho Zineb 65 (Wettable).
Ziram	Zerlate, Zirberk, Karbam White, Corozate.

Ferbam is not used as extensively for vegetable disease control as the other organic fungicides listed above. It is effective for control of certain blackberry and raspberry diseases.

To prepare a spray, mix one of the purchased products with water according to directions on the package.

Use a dust containing 5 to 10 percent of the fungicide. (See "Dusts," p. 2.)

Mention of a proprietary product in this publication is not a guarantee or warranty of the product by the U.S. Department of Agriculture and does not imply its approval by the Department to the exclusion of other products that may also be suitable.

Seed-Treatment Chemicals

Protective fungicides for seed decay and damping-off

Certain chemicals, dusted on the seed of some crops, can reduce injury caused by seed decay and damping-off. They are sold under various trade names, some of which are listed below:

Common name	Trade name
Thiram	Arasan 75, Thiram-50.
Chloranil	Spergon.
Dichlone	Phygon Seed Protectant.
Captan	Orthocide-75 Seed Protectant. Captan 50-W.

Follow these directions for treating a small quantity of seed:

1. Tear off the corner of the seed packet.
2. Dip the small blade of a penknife into the dust.
3. Lift out as much dust as will go on the tip of the blade.
4. Insert dust through the hole in the packet.
5. Fold down corner of packet.
6. Shake the seed thoroughly.

The directions on the fungicide package will tell you how much dust to use for treating a large quantity of seed. Place the dust and seed in a closed container. Shake the container 1 to 2 minutes.

Do not eat treated seed or feed it to livestock.

TABLES OF MEASURES

The following tables of measures are useful in preparing small quantities of insecticide for garden application.

Liquid measures:

3 teaspoons=1 tablespoon	2 cups=1 pint
2 tablespoons=1 fluid ounce	2 pints=1 quart
8 fluid ounces=1 cup	4 quarts=1 gallon

Approximate quantities of powder required to weigh 1 ounce:

Carbaryl wettable powder	6 level tablespoons
Chlordane wettable powder	5 level tablespoons
Dicofol wettable powder	5 level tablespoons
Malathion wettable powder	4 level tablespoons
Methoxychlor wettable powder	4 level tablespoons
Sulfur wettable powder	3 level tablespoons
Toxaphene wettable powder	3 level tablespoons

Compatibility of Pesticides

The following pesticides—insecticides and fungicides—are compatible with one another and may be used together in spray mixtures. Any pesticide in the list can be used with any one or several of the others;

Chlordane	Maneb
Diazinon	Naled
Dicofol	Pyrethrum
Dimethoate	Rotenone
Endosulfan	Thiram
Ferbam	Toxaphene
Malathion	Zineb

The other pesticides recommended in this bulletin for use on the green

foliage of plants are also compatible except as follows:

Emulsifiable concentrate of methoxychlor may cause injury to foliage if mixed with sulfur, ferbam, maneb, thiram, zineb, or ziram. Methoxychlor wettable powder is compatible with these fungicides.

Mixtures of the fixed coppers with diazinon, ferbam, ziram, maneb, thiram, or zineb may decompose upon standing.

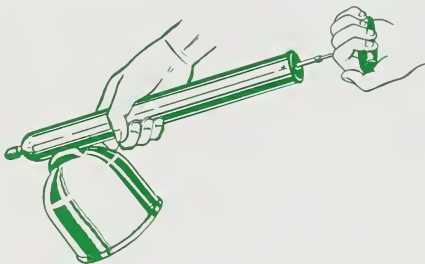
Mixtures of captan with emulsifiable concentrates of methoxychlor, chlordane, dicofol, endosulfan, or malathion may cause injury to the foliage. Captan is compatible with wettable powders of these insecticides.

Spraying and Dusting Equipment

There are many kinds of sprayers and dusters available under different trade names. You can apply insecticides and fungicides easily and efficiently if you use good equipment manufactured expressly for the purpose. Below are some points to consider in selecting sprayers and dusters.

Sprayers

Hand atomizers.—Hand atomizers vary in capacity from $\frac{1}{2}$ pint to 3 quarts. They are very useful for applying all-liquid pesticides to small plant-



EPQ-1854

This hand atomizer has a copper spray chamber. Some hand atomizers come with removable glass chambers that resemble fruit jars.



EPQ-1855

This compressed-air sprayer holds 2 gallons of spray, and it operates at about 50 pounds of pressure, which is obtained by a plunger-type handpump. The handle of the pump also serves as the handle of the sprayer.

ings. Wettable powders tend to clog the nozzles.

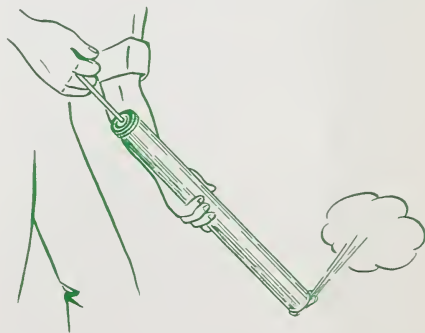
Choose an atomizer with an adjustable nozzle that can be turned upward or downward and that will deliver a continuous spray. The nozzle and spray chamber should be made of a noncorrosive material and should be so constructed that they can be easily cleaned.

Compressed-air sprayers.—Compressed-air sprayers, which are usually made of galvanized steel, range in capacity from 1 to 5 gallons. They are the most satisfactory sprayers to use in the garden. Some types are not equipped with an agitator and must be shaken frequently during spraying.

Dusters

Plunger.—Plunger-type dusters range in capacity from 1 to 3 pounds. They are the most practicable applicators for the small garden. They are usually equipped with tube and nozzle attachments, which permit the dust to be directed to the underside of leaves.

Fan or crank.—Fan- or crank-type dusters have capacities up to 15 pounds and can be used satisfactorily in small and large areas. These dusters are more efficient and durable than other types of hand dusters.



EPQ-1851

This plunger-type duster is ideal for treating individual plants and small areas.

Precautions

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers—out of reach of children and pets—and away from foodstuff.

Apply pesticides selectively and carefully. Do not apply a pesticide when there is danger of drift to other areas. Avoid prolonged inhalation of a pesticide spray or dust. When applying a pesticide it is advisable that you be fully clothed.

After handling a pesticide, do not eat, drink, or smoke until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly. Launder clothing before wearing.

Chlordane, diazinon, dimethoate, naled, and toxaphene can be absorbed directly through the skin in harmful quantities. When working with these pesticides in any form, take extra care not to let them come in contact with the skin.

Apply a pesticide only to those crops on which it is recommended. Do not apply more than is recommended. Allow a sufficient waiting period—at least 1 day before a harvest, or longer if the label specifies. Wash all treated vegetables before eating.

Carbaryl.—Do not apply carbaryl to asparagus, beans, carrot, cucumber, eggplant, melons, okra, peas, peppers, pumpkin, squash, sweet corn, or tomato within 1 day before a harvest; or to broccoli, brussels sprouts, cabbage, cauliflower, head lettuce, kohlrabi, parsnip, radish, or rutabaga within 3 days before a harvest. Do not apply carbaryl to blackberry or raspberry within 7 days; or chard, Chinese cabbage, collards, kale, leaf lettuce,

mustard, or spinach within 14 days. Do not apply carbaryl to table beet or turnip within 14 days before a harvest (3 days if tops won't be used for food or feed). Do not apply carbaryl to onion or potato.

Chlordane.—Do not apply chlordane to any plant after the appearance of foliage or fruit that is to be eaten or fed to livestock. Do not repeat soil application of chlordane for at least 3 years. Do not apply chlordane to soil within 2 years before planting asparagus, carrot, parsnip, or radish.

Diazinon.—Do not apply diazinon to peas or tomato within 1 day before a harvest; or to melons or winter squash within 3 days; or to broccoli, cauliflower, or peppers within 5 days; or to beans, blackberry, brussels sprouts, cabbage, cucumber, raspberry, or summer squash within 7 days; or to carrot, celery, collard, kale, lettuce, onion, parsnip, radish, spinach, or turnip within 10 days; or to table beet within 14 days; or to potato within 35 days before a harvest. Do not apply diazinon to foliage of asparagus, eggplant, kohlrabi, okra, pumpkin, mustard, or rutabaga.

Dicofol.—Do not apply dicofol to blackberry, cucumber, melons, peppers, squash, raspberry, or tomato within 2 days, or to beans within 7 days before a harvest. Do not use dicofol on beans or potatoes.

Dimethoate.—Do not apply dimethoate to peppers within 1 day before a harvest, to tomato within 7 days, or to spinach within 14 days.

Endosulfan.—Do not apply endosulfan to cucumber, eggplant, pepper, potato, pumpkin, squash, or tomato within 1 day before a harvest; or to broccoli or cabbage within 7 days; or to brussels sprouts or cauliflower within 14 days; or to collards, kale, mustard, spinach, or turnip within 21 days before a harvest. Do not apply more than once to kale, mustard, spinach, or

turnip. Do not feed treated plants to livestock. Do not apply to beets, beans, kohlrabi, or chard. Apply only to plants for which it is recommended on the label.

Fungicides.—Do not apply zineb to beet or carrot within 7 days before a harvest if the tops are to be used as food. Do not apply ferbam or ziram to carrot within 7 days before a harvest if the tops are to be used as food. Do not apply zineb to chard or spinach within 7 days before a harvest. Do not apply ferbam to blackberry or raspberry within 40 days. Do not apply ziram on potato. Do not apply ferbam on potato or sweetpotato. Fungicides may be used up to 1 day before a harvest on other crops for which they are recommended.

Malathion.—Do not apply malathion to asparagus, beans, blackberry, cucumber, melons, okra, squash, tomato, or raspberry within 1 day before a harvest; or to broccoli, eggplant, onion, peas, peppers, pumpkin, rutabaga, or turnip (including tops) within 3 days; or to sweet corn within 5 days; or to beet tops, brussels sprouts, cabbage, carrot, cauliflower, celery, collard, kale, kohlrabi, head lettuce, mustard, radish, or spinach within 7 days; or leaf lettuce within 14 days before a harvest.

Methoxychlor.—Do not apply methoxychlor to cantaloup, cucumber, eggplant, kohlrabi, peppers, pumpkin, squash, tomato, or turnip (if tops are not to be used) within 1 day before a harvest; or to asparagus, beans, blackberry, blackeye pea, cabbage, or

raspberry, within 3 days; or to beet or carrot (if tops are not to be used), cauliflower, pea, radish, rutabaga, or sweet corn within 7 days; or to beet tops, broccoli, brussels sprouts, carrot tops, collard, kale, lettuce, spinach, or turnip tops within 14 days before a harvest. Do not apply methoxychlor to onions or okra.

Naled.—Do not apply naled to broccoli, brussels sprouts, cabbage, cauliflower, chard, cucumber, eggplant, lettuce, melons, peppers, pumpkin, spinach, squash, tomato, or turnip within 1 day before a harvest. Do not apply naled to beans, table beet, blackberry, celery, collards, kale, kohlrabi, mustard, okra, onion, peas, potato, raspberry or sweet corn.

Toxaphene.—Do not apply toxaphene to tomato within 3 days or to eggplant or peppers within 5 days before a harvest. Do not apply to celery after bunch begins to form or stalk is half grown. Do not apply to other crops after appearance of parts to be eaten or fed to livestock. Do not apply toxaphene to asparagus, beets, chard, endive, melons, mustard, potato, squash, sweetpotato, or turnip.

Dispose of empty pesticide containers by wrapping them in several layers of newspaper and placing them in your trash can.

It is difficult to remove all traces of a herbicide (weed killer) from equipment. Therefore, to prevent injury to desirable plants to not use the same equipment for insecticides and fungicides that you use for a herbicide.

OTHER CONTROL MEASURES

Insecticides and fungicides, although effective in controlling a large number of garden pests, will not eradicate all insects or cure all diseases. Plant diseases can rarely be cured, but must be controlled by prevention.

The following measures will help prevent losses caused by insects and diseases:

1. Use fertile, well-drained soil and a good grade fertilizer.

2. Plant crops that are suited to the soil and climate.
3. Keep down weeds and grass.
4. Purchase disease-free seed. Buy certified seed where possible.
5. Treat seed with chemicals to protect against decay and damping-off.
6. Purchase disease-free plants; make sure they do not have swellings on the roots, cankers on the stems, or spots on the leaves.
7. Grow disease-resistant varieties if available. Resistant varieties are available for only a few diseases of certain crops. Some of these varieties are highly resistant; others give partial protection.
8. Destroy plants of each annual crop as soon as harvest is completed.
9. Avoid unnecessary use of insecticides that may kill friendly insects. See "Beneficial Insects" (p. 46).

INSECTS AND DISEASES

ASPARAGUS

Asparagus Beetle

Description.—Adult: Metallic blue to black; orange to yellow markings; $\frac{1}{4}$ inch long. Larva: Olive green to dark gray; $\frac{1}{3}$ inch long. Eggs, which are laid on spears by female beetles, look like shiny black specks. (See p. 15 for color illustration of adult and larva.)

Damage.—Adults and larvae eat foliage; shoots are disfigured.

Distribution.—Throughout United States.

What to do.—Apply a dust or spray containing carbaryl, malathion, or rotenone (pp. 2, 3). *Caution:* Do not apply carbaryl, malathion, or rotenone within 1 day before a harvest. Do not repeat applications of carbaryl within 3 days.

Rust (fungus)

Symptoms and damage.—Elongated, orange-red, powdery pustules (blisters) on stems and foliage; early death of plant tops; reduction in following year's crop. Disease is worst during moist seasons. Fungus lives on remains of diseased tops of previous year.

Distribution.—Throughout United States.

What to do.—Grow rust-resistant varieties such as Mary Washington and Martha Washington; use a dependable strain of seed. Cut diseased tops close to the ground and burn them in the fall.

BEANS

Bean Aphid (plant louse)

Description.—Adult and young: Tiny black insect; looks like cabbage aphid. Bean aphids cluster on stems and under leaves. (See p. 15 for color illustration of cabbage aphid.)

Damage.—Leaves curl and thicken; plants become yellow and unthrifty. Aphids spread virus of common bean mosaic.

Distribution.—Throughout United States; infestations localized.

What to do.—Apply a dust or spray containing diazinon, malathion, or naled (pp. 2, 3). See "Precautions" (p. 7).

Bean Leaf Beetle

Description.—Reddish to yellowish; black spots on back; up to $\frac{1}{4}$ inch long. (See p. 15 for color illustration.)

Damage.—Eats regular-shaped holes in leaves.

Distribution.—In all Eastern States; damage usually restricted to small areas.

What to do.—Apply a dust or spray containing carbaryl or rotenone (pp. 2, 3) to underside of leaves. See “Precautions” (p. 7).

Corn Earworm

Description.—Green, brown, or pink; light stripes along sides and on back; up to $1\frac{3}{4}$ inches long. When insect occurs on tomatoes, it is called tomato fruitworm. (See p. 16 for color illustration.)

Damage.—Eats holes in pods; attacks beans in the fall. Damage is worst in warm, coastal areas.

Distribution.—Throughout United States.

What to do.—Apply carbaryl or methoxychlor as for leafhoppers, below.

Leafhoppers

Description.—Several species. Adults: Green; wedge shaped; up to $\frac{1}{8}$ inch long; they fly quickly when disturbed. Nymphs resemble adults but are smaller; they crawl sidewise like crabs. (See p. 15 for color illustration of adult potato leafhopper.)

Damage.—Adults and nymphs attack beans. Leaves of beans curl, or roll downward, crinkle, and tend to become yellow or bronze. Some plants are dwarfed and may die.

Distribution.—Throughout United States.

What to do.—Apply a dust or spray containing carbaryl, malathion, or methoxychlor (pp. 2, 3).

Caution: Do not apply methoxychlor within 3 days, or carbaryl or malathion within 1 day before a harvest.

Lima-Bean Pod Borer



EPQ-2003

Description.—Pink; pale yellow head; up to $\frac{5}{8}$ inch long; wriggles violently when disturbed.

Damage.—Bores through lima bean pods and eats seed. Seldom a pest of snap beans.

Distribution.—Southern part of United States; most damaging in California.

What to do.—Apply carbaryl as for leafhoppers.

Lygus Bugs



TC-7303

Description.—Several related species including tarnished plant bug. Flat, oval; mottled with white yellow, and black splotches that give it a tarnished appearance; $\frac{1}{4}$ inch long. When disturbed, these active insects fly or move to opposite side of stems; are seldom seen.

Damage.—Adults and nymphs pierce and suck juices from the pods, stems, and blossoms. This feeding causes blossoms and young pods to drop from the plants. Feeding on the older pods causes the pods and seed to be pitted and undesirable for food. The pods may also be deformed.

Distribution.—Throughout United States.

What to do.—Dust or spray with carbaryl as for leafhoppers, above. Clean up and destroy weeds and trash in the fall to prevent overwintering.

Mexican Bean Beetle

Description.—Adult: Copper-colored; oval; $\frac{1}{4}$ inch long; 16 black spots on its back. Larva: Orange to yellow; fuzzy or spiny; up to $\frac{1}{3}$ inch long. (See p. 15 for color illustrations of adult, larva, and pupa.)

Damage.—Adults and larvae feed on pods and on underside of leaves; pods and leaves are skeletonized.

Distribution.—In most States east of Rocky Mountains.

What to do.—Apply a dust or spray containing carbaryl, malathion, methoxychlor, or rotenone (pp. 2, 3) to underside of leaves. See "Precautions" (p. 7).

Seed-Corn Maggot

Description.—Yellowish white; legless; $\frac{1}{4}$ to $\frac{1}{3}$ inch long.

Damage.—Bores into sprouting seed and prevents development of plants; particularly destructive to early planted seed.

Distribution.—Throughout United States.

What to do.—Purchase insecticide-treated seed and plant in warm weather; cool, wet periods retard germination and make seed more susceptible to maggot injury. Replant immediately if maggot damage is heavy.

Spotted Cucumber Beetle

Description.—Yellowish green; 12 black spots on back; $\frac{1}{4}$ inch long. (See p. 15 for color illustration.)

Damage.—Eats holes in leaves; chews on pods.

Distribution.—East of Rocky Mountain. (Closely related species are found throughout United States.)

What to do.—Apply carbaryl, methoxychlor, or malathion as for leafhoppers (p. 10).

Garden Symphylan. (See p. 30.)

Japanese Beetle. (See p. 39.)

Spider Mites. (See p. 24.)

Stink Bugs. (See p. 42.)

Wireworms. (See p. 31.)

Anthracnose (fungus)

Symptoms and damage.—Brown sunken spots, which have pink centers, on pods; elongated, dark-red cankers on stems and leaf veins;

rusty-brown spots on ripe seeds. Disease is most common during cool, moist summers. Fungus is carried on seeds and lives in soil on remains of diseased plants.

Distribution.—Central, Northeastern, and Southeastern States.

What to do.—Rotate crops. Follow recommendations for bacterial blights, below.

Bacterial Blights

Symptoms and damage.—Large, dry, brown spots on leaves, often surrounded by yellow borders; water-soaked spots with reddish margins on pods; reddish cankers on stems. Plants may be girdled. Bacteria are carried on seed. (See p. 34 for color illustration.)

Distribution.—Throughout United States, but seldom found west of the Rocky Mountains.

What to do.—Plant western-gown seed. Do not plant discolored seeds or those that come from spotted pods. Avoiding working in the garden when plants are wet; disease spreads more rapidly on wet foliage.

Common Bean Mosaic (virus)

Symptoms and damage.—Mottled (light and dark green) and curled leaves; stunted plants; reduced yields. Virus is carried in seed and spread by aphids (plant lice). (See p. 34 for color illustration.)

Distribution.—Throughout United States.

What to do.—Grow common bean mosaic-resistant varieties such as Topcrop, Tendercrop, Contender, Wade, Puregold Wax, Kentucky Wonder (pole), and Blue Lake (pole).

Rust (fungus)

Symptoms and damage.—Red to black pustules (blisters) on leaves. Leaves turn yellow and drop. Fungus lives through winter on remains of

diseased plants. (See p. 33 for color illustration.)

Distribution.—Throughout United States, except in some semiarid regions.

What to do.—Apply sulfur spray (p. 3) or undiluted sulfur dust. Grow varieties such as Harvester, Tender-white, Tendergreen, Kingham, Cherokee Wax, and Rust Resistant Kentucky Wonder (pole), which have some resistance to rust.

Seed Decay (fungi)

Symptoms and damage.—Seed rot in soil. Disease is most common during cool, moist weather. Fungi live in soil.

Distribution.—Throughout United States.

What to do.—Purchase treated seed.

BEET AND CHARD

Beet Webworm



TC-7116

Description.—Yellow to green; a black stripe and numerous black spots on back; up to $1\frac{1}{4}$ inches long.

Damage.—Eats leaves and buds of young plants. Rolls and folds leaves; ties them together with webs.

Distribution.—Throughout United States; especially troublesome in Western States.

What to do.—Apply a pyrethrum dust containing 0.2 percent pyrethrins (active ingredients) or apply a pyrethrum spray (p. 3).

Blister Beetles



EPQ-2001

Description.—Many species. Gray, black, or striped; slender; $\frac{1}{2}$ to $\frac{3}{4}$ inch long.

Damage.—The beetles eat leaves.

Distribution.—Throughout United States; infestations localized; usually occur late in season.

What to do.—Apply a dust or spray containing carbaryl or methoxychlor. (See pp. 2, 3.) Handpick beetles; wear gloves while picking as the beetles discharge a caustic fluid that may blister the skin. See "Precautions" (p. 7).

Flea Beetles. (See p. 41.)

Damping-Off (fungi)

Symptoms and damage.—Seed decay in soil; young plants collapse and die. Fungi live in soil.

Distribution.—Throughout United States.

What to do.—Treat seeds with a protective fungicide (p. 4).

Leaf Spot (fungus)

Symptoms and damage.—Numerous small, round spots with light-tan centers and dark-brown borders on leaves. Fungus is carried on seed and lives in soil or on remains of diseased plants.

Distribution.—East of Rocky Mountains.

What to do.—Apply a dust or spray containing a fixed copper fungicide or apply zineb (p. 4). Disease usually is not severe enough to require regular treatments.

BLACKBERRY AND DEWBERRY

Orange Tortrix

Description.—Yellow to green larva; light-brown head; up to $\frac{1}{2}$ inch long.

Damage.—Feeds in berries or within a web on leaves.

Distribution.—Destructive to bramble berries in California, Oregon, and Washington.

What to do.—Apply a dust or spray containing carbaryl (pp. 2, 3) in spring when the plants begin to grow. Repeat treatments at 10-day intervals until the plants begin to bloom. *Caution:* Do not apply carbaryl within 7 days before a harvest.

Raspberry Crown Borer

Description.—Larva: White, grub-like, $\frac{1}{4}$ to $1\frac{1}{4}$ inches long. Egg: Oval, deep reddish brown, about $\frac{1}{16}$ inch long, laid under surface of leaf. Adult: Clear-winged moth that resembles a common wasp; black body crossed by yellow bands.

Damage.—In fall the young larvae burrow into the bark of plants, near the soil. Older larvae hollow out crowns of plants.

Distribution.—Northern part of United States.

What to do.—Drench the crowns and lower canes of the plants with diazinon spray when the eggs hatch in early September or October. Repeat the treatment in about 2 weeks. *Caution:* Do not apply diazinon while fruit is present.

Raspberry Fruitworms



EPQ-2006

Description.—Several species. Adults: Yellow to brown beetles; $\frac{1}{4}$ inch long. Larvae: Brown and white; up to $\frac{1}{8}$ inch long.

Damage.—Adults make long, narrow slits in blossom buds and newly formed leaves; larvae feed in berries.

Distribution.—In Northern States.

What to do.—Apply a dust or spray containing rotenone (pp. 2, 3) to foliage 7 days after the first blossoms ap-

pear. Repeat 3 times at 10-day intervals.

Red-Necked Cane Borer

Description. — Adult: Dark-bronze or black beetle; shiny, copper-red neck; slender; about $\frac{1}{4}$ inch long. Larva: White; flat head; slender; up to $\frac{3}{4}$ inch long.

Damage.—Adults eat margins of leaves; larvae tunnel canes, causing spindle-shaped swellings on surfaces.

Distribution.—Eastern half of United States.

What to do.—Apply a dust or spray containing rotenone (pp. 2, 3) immediately before plants bloom; repeat in 2 weeks. Cut off infested canes well below the points of injury and destroy them.

Rose Chafer



EPQ-1908

Description.—Gray or fawn-colored beetle; reddish-brown head: long-legged and slender, $\frac{1}{2}$ inch long.

Damage.—Feeds on foliage, buds, flowers, and fruits of blackberry, raspberry, cabbage, beans, beet, and pepper.

Distribution.—Eastern United States.

What to do.—Apply a dust or spray containing methoxychlor (pp. 2, 3). See "Precautions" (p. 7).

Rose Scale

Description.—White, circular, and scaly; $\frac{1}{8}$ inch in diameter.

Damage.—Incrusts bark at base of canes; weakens or kills canes by feeding on sap.

Distribution.—Throughout United States.

What to do.—Keep down weeds in the planting. Remove and destroy infested canes. Apply a dust or spray containing malathion (pp. 2, 3). If the scales persist until the dormant season, apply a spray containing $\frac{1}{2}$ cup of a summer oil emulsifiable concentrate in 1 gallon of water; do not mix this spray with other pesticides, and do not apply it to plants that have green foliage. See "Precautions" (p. 7).

Aphids. (See p. 24.)

Japanese Beetle. (See p. 39.)

Spider Mites. (See p. 24.)

Anthracnose (fungus)

Symptoms and damage.—Small gray spots with dark margins on leaves; purplish spots (about 1 inch in diameter) with ash-gray centers and raised, purplish margins on canes. Spotted canes may crack lengthwise. Fruits of many varieties of blackberries are not badly damaged; but those of Lawton are particularly susceptible. Disease also attacks raspberries. Fungus lives on remains of diseased canes of previous year.

Distribution. — Throughout United States.

What to do.—Make three applications of ferbam (p. 4). Make first application when leaves are exposed $\frac{1}{2}$ to $\frac{3}{4}$ inch; second, just before blossoms open; third, after blossoming. In North Carolina and regions southward, cut all canes close to the ground and destroy them after harvest. In the North, prune away only the fruiting canes.

Double Blossom (fungus)

Symptoms and damage.—Twisted and wrinkled petals; abnormally large flower buds. Short, broomlike growths emerge from infected buds; no berries grow at these points. Diseased canes

produce poor fruits. New canes infected in early summer show no outer symptoms until following spring. Fungus lives in infected blossoms and canes.

Distribution.—Chiefly in Southeastern States.

What to do.—Remove and destroy infected blossoms. In North Carolina and regions southward, cut all canes close to ground after harvest and destroy them.

BROCCOLI. (See Cabbage.)

BRUSSELS SPROUTS. (See Cabbage.)

CABBAGE AND RELATED PLANTS

Cabbage Aphid (plant louse)

Description.—Adult and young: Tiny green to powdery blue; soft bodied; covered with a fine whitish wax. Aphids cluster on leaves. (See p. 15 for color illustration.)

Damage.—Curled and distorted leaves; stunted plants. Aphids may severely damage cabbage, collards, brussels sprouts, broccoli, and kale.

Distribution. — Throughout United States, particularly troublesome in the South.

What to do.—Remove and destroy heavily damaged plants early in season. Cut off and destroy old leaves from large infested collard, broccoli, cauliflower, and kale plants. Apply a dust or spray containing diazinon, malathion, or naled (pp. 2, 3). See "Precautions" (p. 7).

Cabbage Looper

Description.—Pale-green measuring worm; light stripes down back; up to $1\frac{1}{2}$ inches long; doubles up, or loops, when it crawls (See p. 16 for color illustration).

COLOR PLATE 1

MEXICAN BEAN BEETLE
(X4)



Adult

Larva

Pupa



Adult



ASPARAGUS
BEETLE (X5)

Larva



SPOTTED
CUCUMBER
BEETLE (X5)



STRIPED CUCUMBER
BEETLE (X5)



BEAN LEAF
BEETLE (X5)



PEA WEEVIL
(X6)



CABBAGE
APHID (X8)

Wingless



POTATO
LEAFHOPPER
(X8)

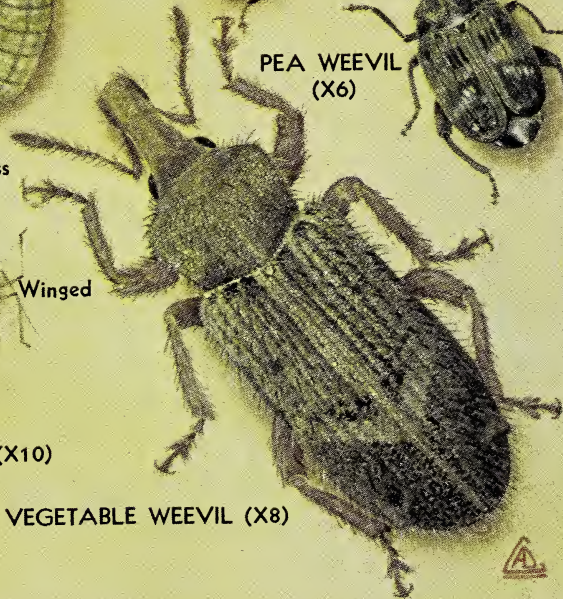


Winged

POTATO FLEA BEETLE (X10)



VEGETABLE WEEVIL (X8)



COLOR PLATE 2

COLORADO POTATO BEETLE
(X4)



Adult

Nymph

Larva



SOUTHERN
GREEN STINK BUG (X4)

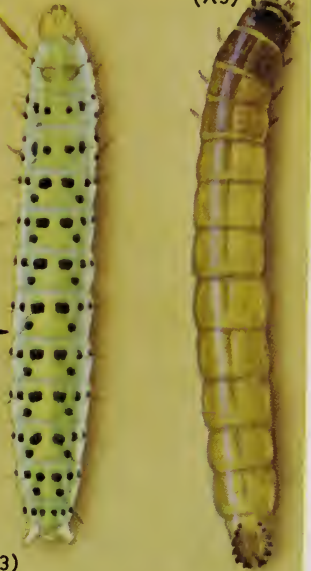


Adult

IMPORTED
CABBAGE-
WORM (X3)



WIREWORM
(X3)



PICKLEWORM
(X7)



CABBAGE LOOPER
(X2)



CORN EARWORM (X3)



Brown

Green

Damage.—Feeds on underside of leaves, producing ragged holes; large loopers burrow into heads.

Distribution. — Throughout United States.

What to do.—Apply a spray or dust containing endosulfan, malathion, or naled (pp. 2, 3). Direct the insecticide to the underside of the leaves. Repeat treatment once a week as long as needed. See "Precautions" (p. 7).

Cabbage Webworm

Description.—Dull grayish yellow; fat; 5 brownish-purple stripes down back; up to $\frac{1}{2}$ inch long.

Damage.—Bores into buds and stems, killing young plants. Feeds under a protective web that it produces. Does little or no damage to spring crop.

Distribution.—Southern United States.

What to do.—Apply a dust or spray containing endosulfan, malathion, or naled (pp. 2, 3). In the South, where the insect causes heavy damage to young plants in late summer and early fall, apply the insecticide as soon as the plants appear. See "Precautions" (p. 7).

Diamondback Moth Caterpillar

Description.—Larva: Light green; slender; up to $\frac{1}{3}$ inch long. It wriggles rapidly when disturbed, and often drops from the plant and hangs by a silken thread, which it produces.

Damage.—Larva eats small holes in leaves and buds; adult (diamondback moth) does no damage.

Distribution.—Throughout United States.

What to do.—Apply the treatment for cabbage looper above.

Imported Cabbageworm

Description.—Velvety green; up to $1\frac{1}{4}$ inches long. (See p. 16 for color illustration.)

Damage.—Feeds on underside of leaves, producing ragged holes; bores into heads.

Distribution. — Throughout United States.

What to do.—Same as for the cabbage looper.

Harlequin Bug



Adult

Nymph

EPQ-1999

Description.—Adult and young: Black; brilliantly colored with red or yellow; shield shaped; up to $\frac{3}{8}$ inch long.

Damage.—Plants wilt; leaves turn brown as if scalded.

Distribution.—In southern part of United States, from California to Virginia; infestations localized.

What to do.—Apply a dust or spray containing endosulfan or naled (See pp. 2, 3). Handpick bugs and crush egg masses (effective if done often).

Root Maggots

Description.—Several species (include seed-corn and cabbage maggots.) Yellowish white; legless, $\frac{1}{4}$ to $\frac{1}{3}$ inch long.

Damage.—Destructive in seedbeds and on young transplants. Tunnel roots and stems, causing rot; plants wilt and die.

Distribution.—Seed-corn maggot, throughout United States; cabbage maggot, in northern part of country.

What to do.—Before planting seed apply 6 ounces of 2-percent diazinon granules to each 100 square feet of soil surface. Mix thoroughly with the upper 4 inches of soil. If transplants are used, water each with 1 cup of diazinon spray (see p. 3).

Cutworms. (See p. 41.)

Flea Beetles. (See p. 41.)

Vegetable Weevil. (See p. 45.)

Blackleg (fungus)

Symptoms and damage.—Ashen-gray spots speckled with tiny black dots on leaves and stems; stems girdled; plants wilt and die. Most common on cauliflower, broccoli, and brussels sprouts. Fungus is carried on seed and lives on crop refuse in soil.

Distribution.—In Central, Southern, and Eastern States.

What to do.—Use Pacific Coast seed free from blackleg fungus. Do not plant in soil that has grown cabbage.

Black Rot (bacterial)

Symptoms and damage.—Blackened veins; stems show a blackened ring when cut across. Leaves turn yellow and drop. Plants may die. Bacteria are carried on seed and live in soil. (See p. 33 for color illustration.)

Distribution.—In Central, Southern, and Eastern States.

What to do.—See blackleg, above.

Clubroot (slime mold)

Symptoms and damage.—Large, irregular swellings, or “clubs,” on roots; unthrifty and stunted plants. Disease attacks plants in seedbeds and in field. May severely damage cabbage, cauliflower, broccoli, brussels sprouts, and kohlrabi. Slime mold lives in soil and enters roots.

Distribution.—Throughout United States.

What to do.—Grow seedlings in clean soil. Do not grow cabbage in soil where disease has occurred. Do not set plants that have swellings on roots. Rotate crops.

Damping-Off (fungi)

Symptoms and damage.—Seed decay in soil; young plants collapse and die. Fungi live in soil.

Distribution.—Throughout United States.

What to do.—Treat seeds with a protective fungicide (p. 4).

Rhizoctonia Disease (fungus)

Symptoms and damage.—Seedling stems dark and shrunk just above soil (injury called wire stem); lower leaves of older plants droop, decay, and turn dark, but do not drop. In cabbage, base of head may rot. Fungus lives in soil.

What to do.—Do not set plants that have wire stem. Rotate crops if possible.

Yellows or Wilt (fungus)

Symptoms and damage.—Yellowish green leaves; stunted plants; lower leaves drop. Disease first attacks one side of plant. May severely damage cabbage, kohlrabi, and kale, Cauliflower, broccoli, and brussels sprouts are resistant. Fungus lives in soil and enters roots.

Distribution.—Throughout United States.

What to do.—Plant seed in clean soil. Grow yellows-resistant varieties such as Jersey Queen, Resistant Detroit, Marion Market, Badger Market, Globe, Wisconsin Ballhead, and Wisconsin All-Season. Spraying is of no value.

CANTALOUPE. (See Muskmelon.)

CARROT

Carrot Caterpillar



EPQ-2008

Description.—Green; banded with black and yellow markings; up to 2 inches long.

Damage.—Eats leaves; destroys tops. Seldom numerous enough to reduce yield.

Distribution. — Throughout United States.

What to do.—Handpick caterpillars.

Carrot Rust Fly



TC-7121

Description.—Larva: Yellowish white; legless; up to 1/3 inch long.

Damage.—Larva tunnels into fleshy roots; destroys fibrous roots.

Distribution.—In Northeast; in coastal Washington and Oregon.

What to do.—Before planting apply 6 ounces of 2-percent diazinon granules to each 100 square feet of soil surface. Mix thoroughly with the upper 4 inches of soil; wait 1 week before planting.

Six-Spotted Leafhopper. (See p. 23.)

Vegetable Weevil. (See p. 45.)

Wireworms. (See p. 31.)

Leaf Blight (fungus)

Symptoms and damage.—Black or brown spots appear on leaves and leaf stalks; older leaves dry and die. Fungus is carried on seed and lives in remains of infected plants in the soil.

Distribution. — Throughout United States.

What to do.—Rotate crops. If plants show damage, apply a spray containing a fixed copper or organic fungicide; or use copper or organic fungicide dust (p. 4).

Yellows (virus)

Symptoms and damage.—Yellowed young leaves (at center of crown) followed by appearance of a large number of yellowed shoots; reddened and twisted old leaves. Roots are small and of poor quality. Virus, which causes aster yellows, attacks other cultivated and wild plants; it is spread by leafhoppers and lives through winter in perennial plants.

Distribution. — Throughout United States.

What to do.—Same as for six-spotted leafhopper on lettuce (p. 23).

CAULIFLOWER. (See Cabbage.)

CELERY

Celery Leaf Tier



TC-7122

Description.—Greenish; up to 3/4 inch long.

Damage.—Eats holes in leaves and stalks. Rolls and folds leaves; ties them together with webs.

Distribution. — Throughout United States.

What to do.—Make two applications of a pyrethrum dust containing 0.2 percent of pyrethrins (active ingredient) 1/2 hour apart. First application should drive tiers from webs and second should kill them.

Aphids. (See p. 24.)

Damping-Off (fungi)

Symptoms and damage.—Seed decay in soil; young plants collapse and die. Fungi live in soil.

Distribution. — Throughout United States.

What to do.—Treat seed with a protective fungicide (p. 4).

Early Blight (fungus)

Symptoms and damage.—Small, circular, yellowish-brown spots on old leaves. Spots enlarge and later are ashen gray. Disease affects stalks. Fungus is spread by rain and lives in soil.

Distribution. — Throughout United States.

What to do.—Apply a spray containing a fixed copper fungicide, zineb, or ziram (p. 4), or a dust containing copper, zineb, or ziram (p. 4). Remove and destroy plant debris in the fall. Rotate crops. If blight damage is heavy, grow Emerson Pascal, a blight-resistant variety. *Caution:* Remove residues of zineb and ziram by stripping, trimming, and washing.

Late Blight (fungus)

Symptoms and damage.—Small yellow spots on old leaves and stalks. Spots turn dark gray and are speckled with tiny black dots. Fungus is carried on seed and lives in the soil.

Distribution.—Throughout United States.

What to do.—Same as for early blight, above. If disease is common, spraying or dusting should begin in the seedbed; grow Emerson Pascal, a blight-resistant variety.

Pink Rot (fungus)

Symptoms and damage.—Water soaked spots and white to pink cottony growth at base of stalks. Stalks rot and taste bitter. Fungus, which also attacks

cabbage and lettuce, lives in soil for several years.

Distribution.—In Northeastern, North Central, and Southern States.

What to do.—Rotate crops, if possible. Avoid successive planting of celery, lettuce, or cabbage in same soil. Remove and destroy diseased plants.

Yellows (fungus)

Symptoms and damage.—Yellowed leaves; stunted plants. Some plants may die. Fungus lives in soil and enters roots.

Distribution.—In Central and Eastern States.

What to do.—Plant seed in clean soil. Do not set diseased plants. If self-blanching varieties are wanted, grow yellows-resistant varieties such as Michigan Golden, Florida Golden, and Forbes Golden Plume. Green celeries are generally resistant.

CHARD. (See Beet and Chard.)

COLLARDS. (See Cabbage.)

CORN. (See Sweet Corn.)

CUCUMBER

Pickleworm

Description.—Yellowish white; brownish head; up to $\frac{3}{4}$ inch long. Numerous dark spots on young worm. (See p. 16 for color illustration.)

Damage.—Feeds on flowers and leaf buds; tunnels flowers, terminal buds, vines, and fruits.

Distribution.—Southeastern part of country as far north as Connecticut, Illinois, Iowa, and Kansas. Winters in southern Florida and Texas; spreads northward late in season.

What to do.—Very early spring plantings are seldom damaged. Apply a dust or spray containing carbaryl (pp. 2, 3). Begin treating plants at first sign of worms in blossoms and buds; worms must be killed before they enter

the fruits. Repeat treatment once a week. *Caution:* Do not apply insecticides within 1 day before a harvest.

Striped Cucumber Beetle

Description.—Adult: Yellow to black; 3 black stripes down back, $\frac{1}{5}$ inch long. Larva: White; slender; brownish at the ends; up to $\frac{1}{3}$ inch long. (See p. 15 for color illustration.)

Damage.—Adults feed on leaves, stems, and fruit, and spread bacterial wilt. Larvae bore into roots and stems below soil line. Insects usually attack young plants. Damaged plants wilt and sometimes die.

Distribution.—East of Rocky Mountains; related species are found in some Western States.

What to do.—Apply a dust or spray containing carbaryl, malathion, or methoxychlor (pp. 2, 3) as soon as plants appear. Repeat treatment once or twice a week. *Caution:* Do not apply insecticides within 1 day before a harvest.

Aphids. (See p. 24.)

Spider Mites. (See p. 24.)

Anthracnose (fungus)

Symptoms and damage.—Reddish-brown, circular spots on leaves; elongated, tan cankers on stems; round, sunken spots with pinkish-tan centers (later turning dark) on fruits. Also attacks muskmelons and watermelons. Damage worst in warm moist weather. Fungus is carried on seeds and lives in soil.

Distribution.—Central, Eastern and Southern States.

What to do.—Do not grow cucumbers or melons in same soil oftener than once in 3 years. Spray or dust the plants with captan or ziram. If mildew is present, apply a spray containing a fixed copper fungicide or an organic fungicide (p. 4), but do not apply ferbam.

Bacterial Wilt

Symptoms and damage.—Large vines gradually wilt and die (no yellowing of leaves); young plants die rapidly. Old plants may first have only one shoot affected. Bacteria, spread by cucumber beetles, enter and plug water vessels of stems, leaves.

Distribution.—North, Central, and Northeastern States.

What to do.—Remove and destroy wilted plants found early in season. Follow same recommendations as for striped cucumber beetle (p. 21).

Damping-Off (fungi)

Symptoms and damage.—Seed decay in soil; young plants collapse and die. Fungi live in soil.

Distribution.—Throughout United States.

What to do.—Treat seed with a protective fungicide (p. 4).

Downy Mildew (fungus)

Symptoms and damage.—Yellowish, angular spots on older leaves, fruits not affected. Leaves dry, curl, and die. Also attacks muskmelons and watermelons. Fungus is not carried on seeds and does not overwinter in soil. (See p. 34 for color illustration.)

Distribution.—Atlantic Coast and Gulf States.

What to do.—Apply a dust or spray containing a fixed copper fungicide or an organic fungicide (p. 4), but do not apply ferbam. Grow mildew-resistant varieties such as Palmetto, Santee, Ashley, Stono, Smoothie, Fletcher, and Palomar.

Mosaic (virus)

Symptoms and damage.—Mottled (green and yellow) and curled leaves; warty, misshapen and spotted fruits; stunted plants; reduced yields. Also attacks muskmelon, squash, pepper, celery, and tomatoes. Virus lives in perennial weeds—milkweed, ground

cherry, catnip—and is spread by aphids (plant lice). (See p. 33 for color illustration.)

Distribution.—Throughout United States.

What to do.—Remove and destroy perennial weeds. Follow recommendations for aphids on page 24. Grow mosaic-resistant cucumber varieties such as Niagara, Ohio MR 200, Sensation Hybrid, Burpee Hybrid, Surecrop Hybrid, and Table Queen—slicing varieties; and Ohio MR 17, Ohio MR 25, Yorkstate Pickling, Wisconsin SMR 18, and Spartan Dawn F. Hybrid—pickling varieties.

Root Knot (nematode)

Symptoms and damage.—Galls, or swellings, on roots; stunted plants. Galls on small roots are tiny; compound galls on large roots are up to an inch in diameter. Pearly white specks inside galls are egg masses of root knot nematode, which lives in soil. Damages many kinds of plants.

Distribution.—In southern areas; most common south of 40° latitude.

What to do.—If the soil is heavily infested, the best thing to do is to move garden to another location, if possible. For some crops and in some locations, the treatment of the soil with nematocides is practicable. Information on the use of these in your area is best obtained from your State agricultural experiment station or county agent.

Scab (fungus)

Symptoms and damage.—Sunken, dark-brown spots on fruits. Gummy substance oozes from fruits. In moist weather, spots are covered by grayish-olive fungus growth. Some small, brown spots on leaves and stems. Fungus also attacks summer squash, particularly crookneck and yellow straightneck. Damage worse in cool, moist weather. Fungus lives in soil. (See p. 34 for color illustration.)

Distribution.—North Central and Northeastern States.

What to do.—Do not grow cucumbers or squash in same soil oftener than once in 3 years. Grow scab-resistant varieties such as Highmoor, Ashe, and Fletcher—slicing varieties; and Wisconsin SR 6, and Wisconsin SMR 12—pickling varieties. Spraying or dusting is not very effective against scab.

EGGPLANT

Eggplant Lacebug



EPQ-1909

Description.—Adult: Grayish to light brown; flat; lacelike wings; $\frac{1}{6}$ inch long. Nymph: Yellowish; louse-like; spiny; up to $\frac{1}{10}$ inch long.

Damage.—Adults and nymphs feed in groups on underside of leaves. Leaves turn yellow and brown; plants usually die.

Distribution.—The South.

What to do.—Apply a dust or spray containing malathion (pp. 2, 3).

Caution.—Do not apply malathion to eggplant within 3 days before a harvest.

Colorado Potato Beetle. (See p. 30.)

Flea Beetles. (See p. 41.)

Hornworms. (See p. 41.)

Damping-Off (fungi)

Symptoms and damage.—Seed decay in soil; young plants collapse and die. Fungi live in soil.

Distribution.—Throughout United States.

What to do.—Treat seeds with a protective fungicide (p. 4).

Fruit Rot (fungus)

Symptoms and damage.—Brown and shrunken stems at soil line; brown or gray spots on leaves; large, ringed, circular, tan, or brown spots covered with small pustules (blisters) on fruits. Fungus is carried on seed and lives in soil.

Distribution. — Throughout United States.

What to do.—Grow rot-resistant varieties such as Florida Beauty and Florida Market.

Wilt (fungi)

Symptoms and damage.—Slow wilting and stunting of plants. Plants sometimes die. Fungi live in soil.

Distribution. — Throughout United States.

What to do.—Do not plant eggplant in soil that has recently grown tomatoes or potatoes. Rotate crops.

KALE. (See Cabbage.)

KOHLRABI. (See Cabbage.)

LETTUCE

Cabbage Loopers

Description.—Pale-green measuring worm; light stripes down back; up to $1\frac{1}{2}$ inches long; doubles up, or loops, when it crawls. (See p. 16 for color illustration.)

Damage.—Feeds on underside of leaves, producing ragged holes.

Distribution. — Throughout United States.

What to do.—Apply a dust or spray containing malathion or naled. (See pp. 2, 3) See "Precautions" (p. 7).



EPQ-2004

Description.—Light green to black; striped; white inverted Y on front of head; up to $\frac{1}{2}$ inches long.

Damage.—Feeds chiefly on grasses and grains but may attack the foliage of lettuce and cabbage and related crops.

Distribution.—East of Rocky Mountains, except in extreme northern sections.

What to do.—Apply a dust or spray containing naled (pp. 2, 3) to grasses and weeds around the garden and to foliage in the garden that is not to be eaten. Ready-mixed cutworm baits are also effective. See "Precautions" (p. 7).

Six-Spotted Leafhopper

Description.—Adult and young: Light-greenish yellow; slender; wedge shaped; very active; several pairs of tiny black dots on face; up to $\frac{1}{8}$ inch long. Looks like the potato leafhopper, but is broader. Prefers open areas. (See p. 15 for color illustration of potato leafhopper.)

Damage.—Spreads the virus of aster yellows to lettuce, carrots, and asters.

Distribution. — Throughout United States.

What to do.—Plant lettuce in sheltered areas—near hedges, buildings, etc. Apply a dust or spray containing carbaryl, malathion, or methoxychlor (pp. 2, 3) when plants are $\frac{1}{2}$ inch high, repeat treatment once a week. See "Precautions" (p. 7). Leafhoppers must be controlled on all host plants or they will continue to spread disease to lettuce.

Aphids. (See p. 24.)

Wireworms. (See p. 31.)

Drop (fungus)

Symptoms and damage.—Wilting of outer leaves; watery soft rot on stems and old leaves; wilted and decayed plants. Disease worst in moist weather.

Distribution.—Central, Eastern, and Southern States.

What to do.—Avoid close planting and poorly drained soil. Ridge soil slightly about plants to prevent water from accumulating.

Tipburn (physiologic)

Symptoms and damage.—Margins of the tender leaves turn brown and dry. Most severe damage on head lettuce.

Distribution.—Throughout United States.

What to do.—Grow tipburn-resistant varieties such as Great Lakes, Cornell 456, and Pennlake.

Yellows (virus)

Symptoms and damage.—Yellowing, blanching, curling, and twisting of inner leaves. Virus, which causes aster yellows, attacks other cultivated and wild plants. Virus lives in perennial plants and is spread by leafhoppers.

Distribution.—Throughout United States.

What to do.—Same as for six-spotted leafhopper, page 23.

MUSKMELON AND CANTALOUPE

Aphids (plant lice)

Description.—Many species. Adults and young are tiny, green to black, and soft bodied; they cluster on underside of leaves or on stems or roots. (See p. 15 for color illustrations of cabbage aphid.)

Damage.—Curled and distorted leaves; stunted plants. Severely damages turnip, melons, cucumber, peas,

beans, tomato, potato, celery, pepper, spinach, and cabbage. Aphids transmit certain virus diseases of vegetables.

Distribution.—Throughout United States.

What to do.—Apply a dust or spray containing diazinon, malathion, or naled. Repeat treatments weekly, as needed. Apply malathion to cucumber, squash, and cantaloupe only when the plants are dry. Read "Precautions" (p. 7) before applying any of these insecticides. Do not apply to crops not specified on container label.

Pickleworm

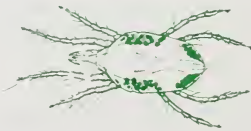
Description.—Yellowish white; brownish head; up to $\frac{3}{4}$ inch long. Numerous dark spots on young worm. (See p. 16 for color illustration.)

Damage.—Feeds on flowers and leaf buds; tunnels flowers, terminal buds, vines, and fruits.

Distribution.—Southeastern part of United States, as far north as Connecticut, Illinois, Iowa, and Kansas. Winters in southern Florida and Texas, spreads northward late in season.

What to do.—Very early spring plantings are seldom damaged. Apply a dust or spray containing carbaryl (pp. 2, 3). Begin treating plants at first sign of worms in blossoms or buds; worms must be killed before they enter fruits. Repeat treatment once a week. Do not treat within 1 day before a harvest.

Spider Mites



TC-7114

Description.—Several species. Adults and young: Tiny (barely visible to naked eye); red or greenish red. Found on underside of leaves. Not classified as insects.

Damage.—Yellow specks and fine webs on leaves; plants and fruits are stunted. Attack beans, blackberry, cucumber, melons, and tomato.

Distribution.—Throughout United States.

What to do.—Apply a dust or spray containing dicofol (pp. 2, 3). Partial control may be obtained by applying a dust containing 25 to 30 percent of sulfur or by applying a spray containing sulfur. *Caution:* Sulfur may cause injury to cucumber and melons. See "Precautions" (p. 7).

Striped Cucumber Beetle

Description.—Adult: Yellow to black; 3 black stripes down back; $\frac{1}{2}$ inch long. Larva: White; slender; brownish at the ends; up to $\frac{1}{3}$ inch long. (See p. 15 for color illustration of adult.)

Damage.—Adults feed on leaves, stems, and fruit, and spread bacterial wilt of cantaloup and cucumber. Larvae bore into roots and also feed on stems at or below soil line. Insects usually attack young plants. Damaged plants wilt and sometimes die.

Distribution.—East of Rocky Mountains; related species are found throughout United States.

What to do.—Apply a dust or spray containing malathion or methoxychlor (pp. 2, 3) as soon as plants appear. Repeat treatment once or twice a week as needed. Do not apply these insecticides within 1 day before a harvest.

Downy Mildew (fungus)

Symptoms and damage.—Irregular brownish spots on older leaves; fruits not affected. Leaves dry, curl, and die. Also attacks cucumbers and watermelons. Fungus is not carried on seed, does not overwinter in soil.

Distribution.—Atlantic Coast and Gulf States.

What to do.—Apply a dust or spray containing a fixed copper or organic

fungicide (p. 4), but do not use ferbam. Grown mildew-resistant varieties such as Delta Gold, Georgia 47, Edisto 47, Perlita, Home Garden, and Gulfstream.

Leaf Spot (fungus)

Symptoms and damage.—Numerous small, round, brown spots on leaves; no spotting of fruits. Many leaves may be killed. Fungus lives on remains of diseased vines in soil.

Distribution.—Central, Southern, and Atlantic States.

What to do.—Do not grow melons or cucumbers in same soil oftener than once in 3 years. Apply a dust or spray containing a fixed copper or organic fungicide (p. 4), but do not use ferbam.

Mosaic (viruses)

Symptoms and damage.—Mottled (green and yellow) and curled leaves; stunted plants; reduced yields. Mosaic diseases are caused by watermelon mosaic viruses 1 and 2 in the South and West, by tobacco ringspot virus in the Central United States east of the Rocky Mountains, and by cucumber mosaic and squash mosaic viruses nationally. Viruses live in perennial weeds, in soil, or in seed. Squash mosaic viruses are carried in squash and muskmelon seed; tobacco ringspot virus is soil-borne; watermelon mosaic viruses and cucumber mosaic viruses are spread by aphids; and squash mosaic virus is spread by cucumber beetles.

Distribution.—Throughout United States.

What to do.—Remove and destroy perennial weeds and diseased plants. Do not plant seed from infected plants. Follow recommendations for aphids (p. 24) and striped cucumber beetle (p. 25.)

Anthracnose. (See p. 21.)

Bacterial Wilt. (See p. 21.)

Damping-Off. (See p. 22.)

Root Knot. (See p. 22.)

MUSTARD. (See turnip.)

OKRA

Corn Earworm

Description.—Green, brown or pink; up to $1\frac{3}{4}$ inches long. (See p. 16 for color illustrations.)

Damage.—Eats holes in pods.

Distribution.—Wherever okra is grown.

What to do.—Handpick and destroy worms and damaged pods. Apply a dust or spray containing carbaryl (pp. 2, 3). (Do not apply carbaryl within 1 day before a harvest).

Aphids. (See p. 24.)

Japanese Beetle. (See p. 39.)

Stink Bugs. (See p. 42.)

Root Knot (nematode)

Symptoms and damage.—Galls, or swellings, on roots; stunted plants. Galls on small roots are tiny; compound galls on large roots are up to an inch in diameter. Pearly white specks inside galls are egg masses of root knot nematode, which lives in soil. Damages many kinds of plants.

Distribution.—In southern areas; most common south of 40° latitude.

What to do.—See Root knot (p. 22).

Wilt (fungi)

Symptoms and damage.—Yellow and wilted leaves; stunted plants. Occasionally does serious damage.

Distribution.—In the South.

What to do.—Do not grow okra in soil where wilt has occurred, or in any soil oftener than once in 3 years.

ONION

Onion Maggot

Description.—White root maggot; legless, up to $\frac{1}{3}$ inch long.

Damage.—Burrows into bulbs.

Distribution.—Northern United States.

What to do.—Apply a dust or spray containing malathion (pp. 2, 3). Do not apply malathion within 3 days before a harvest.

Onion Thrips



EPQ-2012

Description.—Adult: Yellow or brownish; winged; active; about $\frac{1}{25}$ inch long. Larva: White; wingless; looks like adult but is smaller.

Damage.—Adults and larvae suck out juices from plants. White blotches appear on leaves; tips of leaves wither and turn brown.

Distribution.—Throughout United States.

What to do.—Apply a dust or spray containing diazinon or malathion (pp. 2, 3). *Caution:* Do not apply diazinon within 10 days or malathion within 3 days before a harvest.

Wireworms. (See p. 31.)

Smut (fungus)

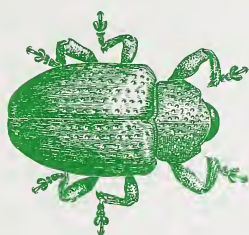
Symptoms and damage.—Black pustules (blisters) filled with masses of fungus on leaves. Disease often kills young plants. Fungus overwinters in soil.

Distribution.—Northern States.

What to do.—Avoid soil where disease has occurred, if possible. Or sprinkle a formaldehyde solution (1 teaspoon to 1 quart of water) over seeds before covering row with soil.

PEAS (Black-eye)

Cowpea Curculio



TC-7126

Description.—Adult: Black; hump backed; snout beetle; $\frac{1}{4}$ inch long. Larva: Whitish; legless; yellowish head; up to $\frac{1}{3}$ inch long.

Damage.—Adults eat small holes in pods and peas. Larvae feed within the green seed.

Distribution.—South Atlantic and Gulf States.

What to do.—Apply a dust or spray containing carbaryl (pp. 2, 3). Treat plants when blossoms are open. Repeat treatment in 3 and 6 days. *Caution:* Do not apply carbaryl within 1 day before a harvest.

PEAS (Garden)

Pea Weevil

Description.—Adult: Brownish; white, black, and grayish markings; $\frac{1}{5}$ inch long. Larvae: White; small brown head and mouth; up to $\frac{1}{3}$ inch long. (See p. 15 for color illustration.)

Damage.—Adults feed in blossoms and lay eggs on young pods. Larvae burrow into green seed.

Distribution.—Throughout United States; most troublesome in Utah, Idaho, Washington, Oregon, California, New York.

What to do.—Apply a dust or spray containing malathion or methoxychlor (pp. 2, 3). Treat plants while in blossom and before first pods form. See "Precautions" (p. 7).

Root Maggots

Description.—Several species (includes seed-corn and cabbage maggots. Yellowish white; legless; $\frac{1}{4}$ to $\frac{1}{3}$ inch long when full grown.

Damage.—Bore into sprouting seeds and prevent development of plants. Destructive in seedbeds and on young transplants. Tunnel roots and stems; plants wilt and die. Attack beans, peas, carrot, melons, spinach, cabbage, turnip, onion, and radish. Particularly destructive to early-season plantings.

Distribution.—Throughout United States.

What to do.—Consult your State agricultural experiment station or county agent for information on seed treatments for root maggot control in your area. Also see recommendations for controlling the seed-corn maggot on beans (p. 11), the onion maggot (p. 26), and root maggots on cabbage (p. 17) and on radish (p. 35).

Aphids. (See p. 24.)

Ascochyta Pod Spot (fungus)

Symptoms and damage.—Irregular, light-colored spots with dark margins on pods; concentric circular spots with tiny dark dots on leaves; spots on stems near soil. Fungus is carried on seed and lives on remains of old infected vines.

Distribution.—Central, Southern, and Northeastern States.

What to do.—Remove and burn diseased vines after crop is picked. Plant western-grown seed.

Bacterial Blight

Symptoms and damage.—Large water-soaked spots on pods; irregular dark spots on leaves; cream-colored, shining ooze in centers of spots. Bacteria are carried on seed and live in remains of vines. (See p. 34 for color illustration.)

Distribution.—Throughout United States, except in semiarid regions of the West.

What to do.—Plant western-grown seed (infection less likely than in seed grown east of Rocky Mountains).

Fusarium Wilt (fungus)

Symptoms and damage.—Yellowed leaves; wilted plants. Interior of stems are lemon yellow. Disease sometimes kills plants. Fungus lives in soil and enters through roots.

Distribution.—Throughout United States.

What to do.—Grow wilt-resistant varieties such as Alaska, Alderman, Progress No. 9, World Record, and Grant Stride.

Root Rots (fungus)

Symptoms and damage.—Yellowish, unthrifty plants; rotted and yellowish-brown, red, or black stems (below ground) and roots. Disease often kills plants at flowering time. Fungus lives in soil.

Distribution.—Throughout United States.

What to do.—Avoid growing peas continually in same soil. Make sure soil is well-drained; excessive moisture favors disease.

Seed Decay (fungi)

Symptoms and damage.—Seeds rot in soil. Disease is most common during cool, moist weather. Fungi live in soil.

Distribution.—Throughout United States.

What to do.—Treat seed with a protective fungicide (p. 4).

PEPPER

Pepper Weevil



EPQ-1904

Description.—Adult: Black snout beetle; gray or yellow markings; $\frac{1}{8}$ inch long. The snout is about half the length of the body. Larva: Grayish-white; pale-brown head; legless; up to $\frac{1}{4}$ inch long.

Damage.—Adults feed on foliage, blossom buds, and tender pods; larvae feed within buds and pods. Large pods are misshapen and discolored; buds and pods may drop off plants.

Distribution.—From Florida and southern Georgia to southern California.

What to do.—Apply a dust or spray containing toxaphene (pp. 2, 3) every week or 10 days. *Caution:* Do not apply this insecticide within 5 days before a harvest.

Aphids. (See p. 24.)

Cutworms. (See p. 41.)

European Corn Borer. (See p. 39.)

Flea Beetles. (See p. 41.)

Hornworms. (See p. 41.)

Leaf Miners. (See p. 41.)

Anthracnose (fungus)

Symptoms and damage.—Large, dark-brown or black spots (whose centers have black specks) on fruits. Sun-scalded fruits often attacked by another fungus that causes spotting similar to anthracnose. Fungus is carried on seed and lives in soil.

Distribution.—Central, Southern, and Atlantic Coast States.

What to do.—Plant clean seed. Treat plants with a dust or spray containing zineb (p. 4).

Bacterial Spot

Symptoms and damage.—Small, yellowish-green spots on young leaves; spots ($\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter) with dead, straw-colored centers and dark margins on old leaves; small, rough, corky looking spots on fruits. Old leaves turn yellow and drop. Bacteria are carried on seed and live in soil. (See p. 34 for color illustration.)

Distribution.—In all but semiarid regions.

What to do.—Plant seed in new seed-bed soil. If plants show damage, apply a dust or spray containing a fixed copper fungicide (p. 4).

Blossom-End Rot (physiologic)

Symptoms and damage.—Light-colored, sunken, water-soaked spots near blossom end of fruits. Spots enlarge; one-third of fruit may become dark and shriveled. Fungi may grow over spots.

Distribution.—Throughout United States.

What to do.—Avoid excessive use of nitrogenous fertilizer and use ample amounts of superphosphate and lime. Maintain even soil moisture at all times.

Cercospora Leaf Spot (fungus)

Symptoms and damage.—Circular, water-soaked spots on leaves and stems. Spots enlarge $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, turn white in centers, and have dark margins. Infected leaves often drop.

Occasionally does serious damage. Fungus is carried on seed.

Distribution.—Most common in Southeastern and Gulf States.

What to do.—Same as for bacterial spot (p. 29).

Damping-Off (fungi)

Symptoms and damage.—Seed decay in soil; young plants collapse and die. Fungi live in soil.

Distribution.—Throughout United States.

What to do.—Treat seeds with a protective fungicide (p. 4).

Mosaic (viruses)

Symptoms and damage.—Mottled (green and yellow) and curled leaves; fruits sometimes are yellowed or show green ring spots; stunted plants; reduced yields. Disease is caused by tomato or cucumber mosaic viruses.

Distribution.—Throughout United States.

What to do.—Follow recommendations for cucumber mosaic (p. 21) and tomato mosaic (p. 44). Grow varieties such as Keystone Resistant Giant, Liberty Bell, Yolo Wonder, and Rutgers World Beater No. 13; they are resistant to tomato mosaic but not to cucumber mosaic.

POTATO

Blister Beetle



EPQ-2001

Description.—Many species. Gray black, or striped; slender; $\frac{1}{2}$ to $\frac{3}{4}$ inch long.

Damage.—Beetles eat leaves.

Distribution.—Throughout United States; usually occur late in season. Infestations localized.

What to do.—Apply a dust or spray containing methoxychlor (pp. 2, 3). Handpick beetles. Wear gloves while picking; the beetles discharge a caustic fluid that may blister the skin.

Colorado Potato Beetle

Description.—Adult: Yellow; black-striped; $\frac{3}{8}$ inch long. Larva: Brick-red; hump back; up to $\frac{3}{5}$ inch long. (See p. 16 for color illustration of adult and larva.)

Damage.—Adults and larvae defoliate eggplant, potato, and tomato; they are especially destructive to small plantings.

Distribution.—In all States except California and Nevada; principal damage in Eastern States.

What to do.—Apply a dust or spray containing carbaryl (pp. 2, 3). Handpick beetles and crush egg masses (effective if done often). See "Precautions" (p. 7).

Garden Spiny-legged



EPQ-2005

Description.—White; fragile; 12 pairs of legs on adult (fewer legs on young); up to $\frac{3}{8}$ inch long. Not classified as insect. Found in moist soils that contain decayed plant material, particularly near greenhouses.

Damage.—Eats numerous tiny holes, or pits, into underground portions of plants; eats off tiny roots and root hairs. Roots of injured plants have blunted appearance. Damages beans, potato, beet, carrot, celery, and spinach.

Distribution.—Throughout humid areas of United States.

What to do.—Difficult to control. Have your soil fumigated by your local pest-control operator.

Grasshoppers



TC-1737

Description.—Many species. Adults and nymphs: Brown, gray, black, or yellow; strong hindlegs; up to 2 inches long. Most grasshoppers are strong flyers.

Damage.—Feed on any available vegetation; when abundant, they may destroy complete plantings of such crops as lettuce and potato.

Distribution.—Throughout United States; they are especially troublesome in Central and Northwestern States.

What to do.—Apply a dust or spray containing malathion (pp. 2, 3). See "Precautions" (p. 7).

Leafhoppers

Description.—Several species. Adults: Green; wedge shaped; up to $\frac{1}{8}$ inch long; they fly quickly when disturbed. Nymphs resemble adults but are smaller; they crawl sideways like crabs. (See p. 15 for color illustration of potato leafhopper.)

Damage.—Adults and nymphs attack potatoes and cause hopperburn. Tips and sides of potato leaves curl upward, turn yellow to brown, and become brittle. Potato and western potato leafhoppers are most destructive.

Distribution.—Potato leafhopper: Eastern United States. Western potato leafhoppers: Parts of Southwest.

What to do.—Apply a dust or spray containing malathion, or methoxychlor (pp. 2, 3).

Potato Tuberworm



TC-7127

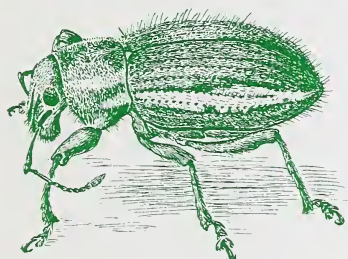
Description.—Pinkish-white; brown head; up to $\frac{1}{2}$ inch long.

Damage.—Tunnels in stems, leaves, and tubers; shoots wilt and die.

Distribution.—Some Southern States and California; infestations localized.

What to do.—Keep garden free of weeds, and keep potato plants deeply hilled with soil. Apply a dust or spray containing endosulfan (pp. 2, 3).

White-Fringed Beetles



EPQ-1903

Adult



EPQ-1912

Larva

Description.—Several species. Adults: Dark-gray snout beetles; light band along the side of the body; $\frac{1}{2}$ inch long. Larvae: Yellowish white; curved; legless; fleshy; up to $\frac{1}{2}$ inch long.

Damage.—Larvae feed on roots and tubers of potato and turnip.

Distribution.—Southeastern United States, infestation localized.

What to do.—Treat infested soil with chlordane as for white grubs below.

White Grubs



C&F-2526

Description.—Several species. White or light yellow; hard brown heads; curved; $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches long when full grown. White grubs live in soil and are larvae of May beetles. They require 3 years to mature.

Damage.—Larvae feed on roots and underground parts of potato and many other plants. Adults feed on tree foliage.

Distribution.—Throughout United States.

What to do.—Grasslands are likely to be infested with white grubs; avoid planting vegetables in newly plowed grasslands. Treat infested soil with chlordane. Apply 5 ounces ($1\frac{1}{3}$ cups) of 40-percent chlordane wettable powder or 45-percent chlordane emulsifiable concentrate in $2\frac{1}{2}$ gallons of water per 1,000 square feet of soil surface. Work the spray into the top 3 inches of soil. *Caution:* Do not apply chlordane within 2 years before planting asparagus, carrot, radish, or parsnip. Do not repeat soil applications of chlordane within 3 years.

Wireworms

Description.—Many species. Yellow to white; dark head and tails; slender; $\frac{1}{2}$ to $1\frac{1}{2}$ inches long when full grown. Resemble a jointed wire. (See p. 16 for color illustration.)

Damage.—Puncture and tunnel stems, roots, and tubers. Severely damage beans, carrot, beet, celery, lettuce, onion, potato, sweetpotato, and turnip.

Distribution.—Throughout United States, particularly in irrigated lands of Western States.

What to do.—Avoid planting vegetables in infested soil.

Treat infested soil with diazinon at least 1 week before planting. Use 6 ounces of 2-percent diazinon granules on each 100 square feet of soil surface. Thoroughly work into top 6 inches of soil immediately after application. If granules are not available, use 4 fluid ounces of 25 percent diazinon emulsifiable concentrate in 2½ gallons of water.

In the North Central and Northeastern States chlordane is effective. Apply 5 ounces (11⅓ cups) of 40-percent chlordane wettable powder or 45-percent chlordane emulsifiable concentrate in 2½ gallons of water per 1,000 square feet of soil surface. Work the spray into the top 6 to 8 inches of soil. **Caution:** Do not apply chlordane within 2 years before planting asparagus, carrots, radish, or parsnip. Do not repeat soil applications of chlordane within 3 years. See "Precautions" (p. 7).

Aphids. (See p. 24.)

Flea Beetles. (See p. 41.)

Mole Cricket. (See p. 42.)

Common Scab (fungus)

Symptoms and damage.—Rough scabby, raised or pitted spots on tubers. Fungus is carried on tubers and lives in soil. (See p. 33 for color illustration.)

Distribution.—Throughout United States.

What to do.—Plant clean tubers. Do not grow potatoes in soil where disease has occurred. Do not use lime, wood-

ashes, or fresh stable manure on infested soil. Grow scab-resistant varieties such as Cayuga, Cherokee, Early Gem, Menominee, Ontario, and Seneca.

Early Blight (fungus)

Symptoms and damage.—Leaves show small, irregular, dark-brown spots, which often enlarge and have targetlike markings. Disease injures foliage, reduces yields. Fungus is carried in soil, may be present in tubers.

Distribution.—Central, Southern, and Eastern States, and parts of the West and Northwest that have overhead irrigation.

What to do.—Plant clean tubers. Apply a dust or spray containing a fixed copper or organic fungicide (p. 4). Rake and burn plant debris. Do not apply ferbam or ziram.

Late Blight (fungus)

Symptoms and damage.—Dark, irregular dead areas on leaves and stems. Infected tubers may rot in storage. Disease may kill plants early in season; it is worse in cool, moist weather. Fungus is carried in tubers.

Distribution.—Most common in North Central, Northeastern, and Atlantic States.

What to do.—Plant clean tubers. Apply a dust or spray containing a fixed copper or organic fungicide (p. 4) every 7 to 10 days, but do not use ferbam or ziram. Grow blight-resistant varieties such as Sebago, Kennebec, Saco, Pungo, Cherokee, and Plymouth. Do not dig up tubers from diseased plants until tops are dead and dry.

Leaf Roll (virus)

Symptoms and damage.—Upward rolling of lower leaves; yellow and stunted plants; brown specks in tubers. Virus is carried in tubers and spread by aphids.

Distribution.—Throughout United States.

COLOR PLATE 3



Black rot of cabbage.



Early blight of tomato.



Blossom-end rot of tomato.



Bean rust.



Mosaic virus disease of squash.



Potato scab.



Cucumber mosaic.



Fusarium wilt of tomato.

COLOR PLATE 4



Tomato mosaic.



Downymildew of cucumber.



Damping-off of
tomato seedlings.



Bacterial spot of pepper.



Cucumber scab.



Bacterial blight of pea.



Bean mosaic.



Bacterial blight of bean.

What to do.—Plant clean tubers; use certified seed potatoes. Grow disease-resistant varieties. Katahdin and Saco are resistant to tuber discoloration and have some resistance to leaf rolling. Kennebec, Sebago, and Chippewa are also resistant to tuber discoloration but leaves may roll. Destroy infected plants as soon as leaf roll is detected; control the aphids.

Mosaic (viruses)

Symptoms and damage.—Mottled (light and dark green) and curled leaves; stunted plants; reduced yields. Caused by several viruses that are carried in tubers and spread by aphids.

Distribution.—Throughout United States.

What to do.—Plant clean tubers; use certified seed potatoes. Grow following varieties (resistant to some forms of mosaic): Cherokee, Chippewa, Katahdin, Kennebec, Pungo, Saco, and Sebago. Destroy infected plants as soon as mosaic is detected; control the aphids.

Wilt and Dry Rot (fungi)

Symptoms and damage.—Yellow leaves; drooping plants; brown rings inside stems and tubers. Infected tubers rot in storage. Fungi are carried in tubers and live in soil.

Distribution.—Throughout United States.

What to do.—Do not plant internally discolored tubers; plant certified seed potatoes. Do not grow potatoes in soil where disease has occurred. Plant resistant varieties—Menominee and Ona.

RADISH

Root Maggots

Description.—Several species (includes seed-corn and cabbage mag-

gots). Yellowish white; legless; $\frac{1}{4}$ to $\frac{1}{3}$ inch long.

Damage.—Maggots tunnel edible roots.

Distribution.—Throughout United States.

What to do.—Before planting apply 6 ounces of 2-percent diazinon granules to each 100 square feet of soil surface. Mix thoroughly with the upper 4 inches of soil; wait 1 week before planting.

RASPBERRY

Aphids. (See p. 24.)

Japanese Beetle. (See p. 39.)

Orange Tortrix. (See p. 12.)

Raspberry Crown Borer. (See p. 13.)

Raspberry Fruitworms. (See p. 13.)

Red-Necked Cane Borer. (See p. 13.)

Rose Chafer. (See p. 13.)

Stink Bugs. (See p. 42.)

Anthracnose (fungus)

Symptoms and damage.—Small gray spots that have dark margins on leaves; purplish spots (about 1 inch in diameter) that have ash-gray centers and raised purplish margins or canes. Badly infected canes are girdled; canes crack lengthwise. Fruits often fail to ripen normally, or wither on canes. Black raspberry canes are more susceptible than those of red varieties. Fungus lives on diseased canes.

Distribution.—Throughout United States.

What to do.—Plant clean nursery stock. Make three applications of ferbam (p. 4). Make first application when leaves are exposed $\frac{1}{2}$ to $\frac{3}{4}$ inch, second, just before blossoms open; third, after blossoming. Cut and burn fruiting canes after harvest.

Remove and destroy new canes that become badly infected.

Leaf Curl (virus)

Symptoms and damage.—Leaves are curled and rounded; tissue between veins is arched upward; fruits ripen prematurely and are not edible. Symptoms first appear at tip of a single cane; following season all canes affected; in a few years shoots may be only a few inches high. Virus attacks both red and black varieties; it is spread by aphids.

Distribution.—From Ohio westward.

What to do.—Same as for mosaic, below.

Leaf Spot (fungus)

Symptoms and damage.—Circular or irregular gray spots, about $\frac{1}{8}$ inch in diameter, on leaves; stunted canes; reduced yields. Severely spotted leaves drop; canes may be nearly bare in fall. Disease worse in hot weather. Fungus lives in diseased leaves on ground.

Distribution.—Eastern United States; particularly in the South.

What to do.—Apply ferbam (p. 4) 3 times at intervals of 3 or 4 weeks. Make first application after harvest, when old canes have been removed.

Mosaic (virus)

Symptoms and damage.—*Red raspberries:* Raised dark-green spots surrounded by yellow-green tissue on leaves; stunted plants; reduced yields. Leaves that develop in hot weather show only faint symptoms. *Black raspberries:* Dwarfed and mottled leaves; stunted plants. Virus may kill tips of shoots; severely stunted plants die. Other viruses cause leaves to become flecked with yellow and green, dwarfed, yellowed, and to curl upward at edges. Mosaic viruses are spread by aphids.

Distribution.—Throughout United States.

What to do.—Plant virus-free stocks. Do not plant healthy plants near diseased ones. Remove and destroy diseased plants; dig up roots to prevent new shoots from appearing.

Orange Rust (fungus)

Symptoms and damage.—Spindly shoots; small, pale-green leaves; blister-like pustules on underside of leaves. Pustules burst, releasing reddish-orange fungus spores. When disease occurs in old hills, only a few canes rust the next spring; in new plantings, infected canes do not blossom, and plants are rusted as long as they live. Attacks black raspberries; rarely affects red varieties. Fungus lives in diseased canes.

Distribution.—Throughout United States.

What to do.—Plant only rust-free stock. If young plants show rust, dig and burn them. If plants in old hills are infected, cut and burn parts of crowns that are injured; remainder of plant may be saved.

RHUBARB

Rhubarb Curculio



TC-7128

Description.—Yellow dusted snout beetle; $\frac{1}{2}$ to $\frac{3}{4}$ inch long.

Damage.—Punctures stems.

Distribution.—New England to Idaho, south to Florida and Louisiana.

What to do.—Handpick. Remove and destroy dock plants growing near garden; beetle breeds in dock plants.

Foot Rot or Crown Rot (fungus)

Symptoms and damage.—Brown sunken spots at base of leaf stalks; decayed stalks; wilted leaves. Disease spreads rapidly in row. Fungus is carried on roots and lives in soil.

Distribution.—Central and Eastern States.

What to do.—Remove and destroy diseased plants. Do not use roots from beds where disease has occurred. Apply a fixed copper spray (p. 4) deep into crowns of plants.

leaf). Spray susceptible plants with zineb (p. 4).

Seed Decay (fungi)

Symptoms and damage.—Seed rot in soil. Disease most common in cool, moist weather. Fungi live in soil.

Distribution.—Throughout United States.

What to do.—Treat seed with a protective fungicide (p. 4).

SPINACH

Aphids. (See p. 24.)

Beet Webworm. (See p. 12.)

Leaf Miners. (See p. 41.)

Blight or Yellows (virus)

Symptoms and damage.—Yellowed and curled leaves; stunted plants; reduced yields. Disease caused by cucumber mosaic virus, spread by aphids.

Distribution.—Throughout United States.

What to do.—Grow blight-resistant varieties—Virginia Savoy and Old Dominion—and resistant hybrids—56 and 612. Remove and destroy perennial weeds. Follow recommendations for control of aphids (p. 24).

Blue Mold (fungus)

Symptoms and damage.—Yellow spots on upper surfaces of leaves; downy, purple, or blue-colored mold on underside of leaves. Disease is worse during cool, humid weather.

Distribution.—Southeastern and Central States.

What to do.—Grow resistant varieties—Dixie Market and Dixie Savoy (savoy), and resistant hybrids—7 (semisavoy), and 424 and 425 (smooth

SQUASH AND PUMPKIN

Pickleworm

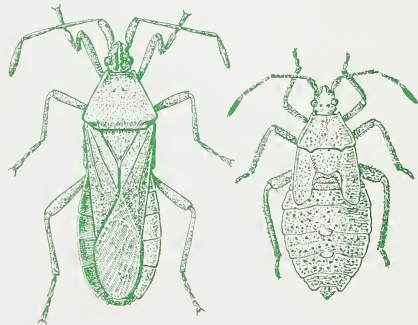
Description.—Yellowish white; brownish head; up to $\frac{3}{4}$ inch long. Numerous dark spots on young worm. (See p. 16 for color illustration.)

Damage.—Feeds on flowers and leaf buds; tunnels flowers, terminal buds, vines, and fruits.

Distribution.—Winters in Florida and Texas; may spread as far north as Connecticut, Illinois, Iowa, and Kansas late in season.

What to do.—Very early spring plantings are seldom damaged. Apply dust or spray containing carbaryl (pp. 2, 3). Begin treatments at first sign of worms in blossoms and buds; worms must be killed before they enter fruits. Repeat treatment once a week.

Squash Bug



Adult

Nymph

EPQ-2010

Description.—Adult: Brownish, flat-back stink bug; $\frac{5}{8}$ inch long. Nymph: Varies from bright green with red head and legs to dark greenish-gray with black head and legs; up to $\frac{3}{8}$ inch long. Egg clusters are shiny brick-red; are found on leaves.

Damage.—Adults and nymphs feed in colonies; they suck sap from leaves and stems. Plants wilt and die.

Distribution.—Throughout United States.

What to do.—Handpick adults and eggs. Trap bugs under boards placed on soil around plants; collect and destroy bugs every morning. Treat plants with a dust or spray containing carbaryl (pp. 2, 3).

Squash Vine Borer



TC-7130

Description.—Larva: White; up to 1 inch long.

Damage.—Bores in vines; eats holes in stem near base of runner. Runner wilts.

Distribution.—East of Rocky Mountains.

What to do.—Locate points of injury. Split one side of stem with razor blade or sharp knife and puncture worm. Put a mound of moist dirt around each cut stem to prevent drying and to induce root growth beyond point of injury. Partial control may be obtained by applying a dust or spray containing carbaryl or endosulfan (pp. 2, 3). Begin applications when runners develop; repeat treatment once a week.

Striped Cucumber Beetle

Description.—Adult: Yellow to black; 3 black stripes down back; $\frac{1}{5}$ inch long. Larva: White; slender; brownish at the ends; up to $\frac{1}{3}$ inch

long. (See p. 15 for color illustration of adult.)

Damage.—Adults feed on leaves, stems, and fruit; they spread bacterial wilt and squash mosaic. Larvae bore into roots and also feed on stems at or below soil line. Damaged plants wilt and sometimes die.

Distribution.—East of Rocky Mountains; related species found in West.

What to do.—Apply a dust or spray containing carbaryl, malathion, or methoxychlor (pp. 2, 3).

Mosaic (viruses)

Symptoms and damage.—Yellow spots on leaves and, occasionally, on fruits; stunted plants; reduced yields. Most common on straightneck and crookneck summer squash. Disease causal agents are same as for muskmelon mosaic viruses (p. 25). (See p. 33 for color illustration.)

Distribution.—Throughout United States.

What to do.—Remove and destroy diseased plants and perennial weeds. Follow recommendations for control of striped cucumber beetle (p. 38) and aphids (p. 24).

Bacterial Wilt. (See p. 21.)

Scab (fungus). (See p. 22.)

SWEET CORN

Corn Earworm

Description.—Green, brown, or pink; light stripes along sides and on back; up to $1\frac{3}{4}$ inches long. When insect occurs on tomatoes, it is called tomato fruitworm. (See p. 16 for color illustration.)

Damage.—Early in the season feeds on central shoot (budworm damage); later burrows through silk and feeds on kernels near tip of ear.

Distribution.—Throughout United States.

What to do.—To prevent budworm damage, spray entire plant. To prevent damage to ear, spray silks until they are wet. Use 3 level tablespoons of 50-percent carbaryl wettable powder per gallon of water. Apply the day after silks appear. Repeat four times, at 2-day intervals.

Corn Sap Beetles

Description.—Several species. Adults: Usually black; $\frac{3}{16}$ inch long. Larvae: White to cream colored; maggotlike; active; up to $\frac{1}{4}$ inch long; they scatter over ear when exposed to light.

Damage.—Adults seldom do damage. Larvae eat into kernels of roasting ears.

Distribution.—Eastern United States, and as far west as Colorado.

What to do.—Apply a spray containing malathion (p. 3) 6 days after silks appear; repeat treatment 10 days later.

European Corn Borer



EPQ-1997

Description.—Pale, pink, or brown; dark-brown head; up to 1 inch long.

Damage.—Feeds in stalks and ears; may enter ear at base, side, or tip. Also feeds on foliage and pods of pepper.

Distribution.—From Georgia to Maine and westward to Montana, Colorado, and Oklahoma.

What to do.—Apply a carbaryl or diazinon spray (p. 3) to ear shoots and centers of leaf whorls at first sign of borers. Repeat treatment at least three times at 5-day intervals. Use about $1\frac{1}{2}$ gallons of spray per 100 stalks; apply it until runoff occurs at the base of the plants.

Japanese Beetle



FR-9705

Description.—Adult: Shiny metallic green; oval; coppery-brown outer wings; about $\frac{1}{2}$ inch long and $\frac{1}{4}$ inch wide. Larva: White body; brown head; up to 1 inch long when full grown.

Damage.—Adults may attack foliage of raspberry, blackberry, beans, and okra, and silk and foliage of sweet corn. Larvae feed on roots of grasses and other plants.

Distribution.—From southern Maine southward into Georgia and westward to the Mississippi River and Iowa.

What to do.—For control of adults, apply a dust or spray containing carbaryl or malathion to infested foliage. Treat lawns and turf areas with milky disease spores to kill larvae in soil. For further information, consult Leaflet 500, "Milky Disease for Control of Japanese Beetle Grubs." See "Precautions" (p. 7).

Bacterial Wilt

Symptoms and damage.—Wilted and dwarfed plants; tassels whiten early. Yellow, bacterial slime oozes from cut stalks. The bacteria are carried on seed; also carried by insects that spread them in the field.

Distribution.—Central, Southern, and Eastern States.

What to do.—Grow wilt-resistant varieties such as Stowell's Evergreen, Golden Cross Bantam, Marcross, Spancross, or Whipcross. Most white late varieties are somewhat resistant; other resistant varieties are listed by seedsmen.

Seed Decay and Seedling Blight (fungi)

Symptoms and damage.—Seed decay in soil; young plants die. Fungi are carried in seed and live in the soil.

Distribution.—Throughout United States.

What to do.—Treat seed with a protective fungicide (p. 4).

Smut (fungus)

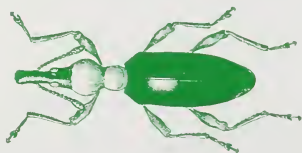
Symptoms and damage.—Large, irregularly shaped white galls, or outgrowths, form on stalks, ears, and tassels. Galls burst, releasing masses of black fungus spores. Fungus lives in soil.

Distribution.—Throughout United States.

What to do.—Remove and destroy galls. Do not use diseased plants in making compost.

SWEETPOTATO

Sweetpotato Weevil



TC-7133

Description.—Adult: Reddish snout beetle; shiny; antlike; slender-bodied; bluish-black head; $\frac{1}{4}$ inch long. Larva: White; legless; pale-brown head; up to $\frac{3}{8}$ inch long.

Damage.—Adults seldom cause damage. Larvae tunnel through sweetpotatoes and vines.

Distribution.—Parts of Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina.

What to do.—The weevil does not hibernate, so there must be food available for it to survive the winter. To prevent the weevil's survival, destroy volunteer plants in the field. Destroy all infested sweetpotatoes in storage. Well before spring, clean out storage places and destroy all plant material. Plant weevil-free seed stock or plants. For further information, contact your county agricultural agent or a State or Federal plant protection inspector.

Wireworms. (See p. 31.)

Black Rot (fungus)

Symptoms and damage.—Black, sunken, roundish spots on sweetpotatoes; black cankers on underground parts of stems. Fungus overwinters in diseased roots and in the soil, and attacks slips in plant bed. Disease is spread in storage.

Distribution.—Throughout United States.

What to do.—Use plants that have clean, white roots. Remove and destroy diseased plants. Do not plant sweetpotatoes in the same soil every year.

Stem Rot or Wilt (fungus)

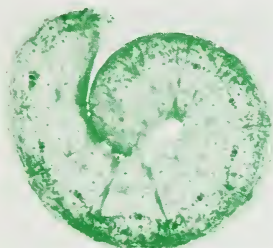
Symptoms and damage.—Yellowed and wilted plants. When cut across, stems have a black discoloration; roots, a black ring. Fungus overwinters in fleshy roots and in the soil, and infects roots and stems of young plants.

Distribution.—Throughout United States.

What to do.—Same as for black rot, above.

TOMATO

Cutworms



EPQ-1911

Description.—Many species. Cutworms are dull gray, brown, or black, and may be striped, or spotted. They are stout, soft-bodied and smooth, and up to $1\frac{1}{4}$ inches long; they curl up tightly when disturbed.

Damage.—Cut off plants above, at, or below soil surface. Some cutworms feed on leaves, buds, or fruits; others feed on the underground portions of plants. Particularly destructive to early-season plants of pepper, tomato, cabbage and related crops, peas, and beans.

Distribution.—Throughout United States.

What to do.—Apply a 10-percent toxaphene dust, or spray with toxaphene. Apply the insecticide to the soil surface when the garden is being prepared for planting. Ready-mixed poison baits containing 3 percent of toxaphene are effective against species that feed above the soil surface. If you use bait, spread it in the late afternoon at the rate of 1 pound per 1,000 square feet. Do not apply toxaphene to foliage of cucumbers or melons; it may injure the plants. See "Precautions" (p. 7).

Note: You can prevent cutworm injury to transplants without using an insecticide. Place a stiff 3-inch cardboard collar around the stems; allow it to

extend about 1 inch into the soil and protrude 2 inches above the soil; clear the stem by about $\frac{1}{2}$ inch.

Flea Beetles

Description.—Many species. Black, brown, or striped; jumping beetles; about $\frac{1}{16}$ inch long. (See p. 15 for color illustration of potato flea beetle.)

Damage.—Attacks potato, tomato, eggplant, pepper, beet, spinach, turnip, radish, and cabbage and related crops. Young plants, especially transplants, are severely damaged; leaves look as if they had been shot full of holes.

Distribution.—Throughout United States.

What to do.—Apply a dust or spray containing carbaryl or endosulfan (pp. 2, 3). See "Precautions" (p. 7).

Hornworms



EPQ-1998

Description.—Two species. Green; diagonal lines on sides; prominent horn on rear end; up to 4 inches long.

Damage.—Eat foliage and fruit of eggplant, pepper, and tomato.

Distribution.—Throughout United States; infestations localized.

What to do.—Handpick worms. If damage is heavy, apply a dust or spray containing carbaryl or endosulfan (pp. 2, 3). See "Precautions" (p. 7).

Leaf Miners

Description.—Larva: Yellow, $\frac{1}{8}$ inch long, lives in leaves. Adult fly: Tiny, black and yellow. Several generations of this insect develop in a summer.

Damage.—Larvae make long, slender, winding, white tunnels in the leaves of tomato, pepper, and spinach.

Distribution.—Throughout United States. Damage usually is not appreciable in the Northern States.

What to do.—Apply a spray containing diazinon or dimethoate (p. 3). See "Precautions" (p. 7).

Mole Crickets



EPQ-2002

Description.—Several species. Adults and nymphs: Light-brown; large, beady eyes; short, stout front legs with shovellike feet; up to 1½ inches long.

Damage.—Make burrows in soil; uproot young plants in seed beds.

Distribution.—In Florida and in coastal areas of North Carolina, South Carolina, Georgia, Alabama, and Mississippi.

What to do.—Apply diazinon before planting, as for wireworms (p. 31). If mole crickets are damaging established plants, apply a ready-mixed, 3-percent chlordane bait. If you use bait, apply it to the soil surface in the late afternoon following rain or watering. Use about 1 pound of bait per 1,000 square feet of soil surface. See "Precautions" (p. 7).

Stalk Borer



EPQ-1016

Description.—Slender, up to 1¼ inches long. *Young borer:* Creamy

white; dark purple band around the body; several brown or purple stripes running lengthwise down the body. *Full-grown borer:* Creamy white to light purple without band and stripes.

Damage.—Eats tunnel in stem, causing plant to wither and die. Tunnel usually has opening up to ¼ inch in diameter at its lower end.

Distribution.—Eastern part of United States.

What to do.—Remove and destroy weeds; the insect breeds in weeds. Plant may be saved by puncturing the insect. To locate the borer split the stems lengthwise above opening to tunnel. Bind split stem and keep plant watered.

Stink Bugs

Description.—Several species. Adults: Brown, green, or black; with or without markings; shield shaped; up to 5⁄8 inch long and 1⁄3 inch wide. Nymphs: Resemble adults but are smaller. Stink bugs discharge a foul odor. (See p. 16 for color illustrations of adult and nymph of southern green stink bug.)

Damage.—Adults and nymphs suck sap from tomato, bean, and okra. Plants are weakened; buds and young fruits are malformed. Pimples, or wartlike growths, appear on okra and bean pods.

Distribution.—Throughout United States, particularly in the south.

What to do.—Do not allow weeds to grow in or around garden. Apply a dust or spray containing carbaryl, endosulfan, or naled (pp. 2, 3). See "Precautions" (p. 7).

Tomato Fruitworm

Description.—Green, brown, or pink; light stripes along sides and on back; up to 1¾ inches long. When insect occurs on corn, it is called corn earworm. (See p. 16 for color illustration of corn earworm.)

Damage.—Eats holes in fruits and buds.

Distribution.—Throughout United States, particularly in Southern States and California.

What to do.—Apply a dust or spray containing carbaryl (pp. 2, 3). Make first application when plants are 1 or 2 feet across or when fruit begins to set. Repeat treatment 3 times at 2-week intervals. See "Precautions" (p. 7).

Tomato Russet Mite

Description.—Not visible to naked eye; mite can be seen with a 20-power hand lens. It is white and pear shaped. Not classified as insect.

Damage.—Lower stems become bronze, or russet; damage spreads up the plant and to underside of leaves; fruit may become bronzed. Plants have smoked appearance.

Distribution.—Mite is most common in California, but localized infestations have been scattered over the United States.

What to do.—Apply a dust containing 25 to 50 percent of dusting sulfur when fruit begins to set, or use a spray containing sulfur (p. 3). Re-treat every 2 weeks. *Caution:* Higher dosages of sulfur dust may injure plants.

Aphids. (See p. 24.)

Blister Beetles. (See p. 12.)

Colorado Potato Beetle. (See p. 30.)

Spider Mites. (See p. 24.)

Blossom-End Rot (physiologic)

Symptoms and damage.—Large, dark, sunken, leathery spots at the blossom end of fruits, caused by a deficiency of calcium. Most common during droughts when soil dries rapidly while plants are making a vigorous growth. (See p. 33 for color illustration.)

Distribution.—Throughout United States.

What to do.—Use ample amounts of lime and superphosphate. Avoid excessive use of nitrogenous fertilizers. When watering garden, maintain even moisture in soil.

Damping-Off (fungi)

Symptoms and damage.—Seed decay in soil; young plants collapse and die. Fungi live in soil. (See p. 34 for color illustration.)

Distribution.—Throughout United States.

What to do.—Treat seed with a protective fungicide (p.4).

Early Blight (fungus)

Symptoms and damage.—Leaves show small irregular dark-brown spots which often enlarge into circular spots that have targetlike markings. Brown cankers on stems that may girdle plants at ground line. Dark, leathery, decayed spots at stem end of fruits. Disease is worse in warm, moist weather. Fungus may be carried on seeds; lives in soil. (See p. 33 for color illustration.)

Distribution.—Throughout United States, except semiarid regions.

What to do.—Use clean plants. Apply a dust or spray containing a fixed copper or organic fungicide (p. 4) to plants every 7 to 10 days.

Fusarium Wilt (fungus)

Symptoms and damage.—Gradual yellowing and wilting of foliage (beginning with lower leaves); browning of woody tissue under the outer green portion of the stem. Plants may die. Fungus lives in soil and enters through roots. (See p. 33 for color illustration.)

Distribution.—Throughout United States, particularly in Southern States.

What to do.—Grow wilt-resistant varieties such as Homestead, Manapal, Floradel, Manalucie, KC 146, Marion, Kokomo, Enterpriser, Porte, H 1350, Campbell's 17, Pinkshipper (pink), and Sunray (yellow).

Late Blight (Fungus)

Symptoms and damage.—Dark water-soaked spots on leaves; large water-soaked spots on fruits; white fungus growths on underside of leaves and occasionally on fruits during moist weather. Spots on leaves enlarge and turn brown; leaves wither. Spots on fruits turn brown and remain firm. Disease is worse in cool, moist weather. Fungus causes late blight of potatoes.

Distribution.—In humid areas, particularly east of the Mississippi River.

What to do.—Apply a dust or spray containing a fixed copper or organic fungicide (p. 4), but do not apply ferbam or ziram. Repeat treatment every 7 to 10 days.

Leaf Spot (fungus)

Symptoms and damage.—Small spots that have light centers and dark margins on leaves; dark specks in centers of spots. Many leaves may be killed, and crop reduced. Disease worse in warm, moist weather. Fungus lives in soil and on perennial weeds.

Distribution.—North Central, Northeastern, and Southeastern States.

What to do.—Remove or turn under vines in the fall. Destroy perennial weeds. Rotate crops. Apply a dust or spray containing a fixed copper or organic fungicide (p. 4).

Mosaic (virus)

Symptoms and damage.—Mottled (green and yellow) and curled foliage; stunted plants (if attacked early in season); reduced yields. Caused by tobacco mosaic virus, which is often present in manufactured tobacco; smokers may carry it on their hands and transmit it to tomato plants. The disease is spread by persons who handle plants and also by aphids. Virus is not carried in seed and does not live long in soil. (See p. 34 for color illustration.)

Distribution.—Throughout United States.

What to do.—Avoid handling young plants. If you smoke, wash hands with soap and water before working in the garden; do not smoke while working with tomato plants.

Root Knot (nematode)

Symptoms and damage.—Galls, or swellings, on roots; stunted plants. Galls on small roots are tiny; compound galls on large roots may be an inch in diameter. Pearly white specks inside galls are egg masses of root knot nematode, which lives in soil. Damages many kinds of plants.

Distribution.—In southern areas; most common south of 40° latitude.

What to do.—See "Root knot" (p. 22).

Verticillium Wilt (fungus)

Symptoms and damage.—Symptoms of verticillium wilt are easily mistaken for those of fusarium wilt; both diseases cause the branches to wilt and die. However, the symptoms of verticillium wilt usually appear at the same time on all branches of a plant, whereas those of fusarium wilt may appear on a single shoot that will wilt and die before the rest of the plant is affected. The fungus that causes verticillium wilt lives in the soil. Fruit of plants it attacks may sunburn when exposed to the sun, and the plants also may die.

Distribution.—California, Utah, Washington, Colorado, the North Central and Northeastern States, and southern Florida.

What to do.—Grow resistant varieties such as H 1350, Porte, Enterpriser, Pearson types VF6 and VF36, and Campbell's 17. These varieties are also resistant to fusarium wilt. VR Moscow and Loran Blood are resistant to verticillium wilt only. Sprays and dusts are not effective against verticillium wilt.

TURNIP AND MUSTARD

Harlequin Bug

Description.—Adult and nymph: Black and brilliantly colored with red or yellow; shield shaped; up to $\frac{3}{8}$ inch long.

Damage.—Plants wilt; leaves turn brown as if scalded.

Distribution.—In southern part of United States from California to Virginia. Infestations localized.

What to do.—Apply a dust or spray containing endosulfan. (See pp. 2, 3.) See "Precautions" (p. 7).

Turnip Aphid (plant louse)

Description.—Tiny; greenish; looks like cabbage aphid but is not covered with whitish wax. Feeds in colonies on underside of leaves. (See p. 15 for color illustration of cabbage aphid.)

Damage.—Curled leaves and yellowed plants.

Distribution.—Throughout United States, except in the Northwestern States. (Related species are found on turnips and mustard.)

What to do.—Apply a dust or spray containing malathion every 7 to 10 days, beginning as soon as true leaves form. See "Precautions" (p. 7).

Vegetable Weevil

Description.—Adult: Dull, grayish-brown; 2 oval pale-gray marks on back; $\frac{3}{8}$ inch long. Larva: Light-green body and light-yellow to brown head; $\frac{5}{8}$ inch long when full grown. (See p. 15 for color illustration of adult.)

Damage.—Adults and larvae feed on leaves and roots of turnip, cabbage and related plants.

Distribution.—Southern United States.

What to do.—Apply a dust or spray containing rotenone (pp. 2, 3).

Cabbage Looper. (See p. 14.)

Cabbage Webworm. (See p. 17.)

Flea Beetles. (See p. 41.)

Root Maggots. (See p. 27.)

Wireworms. (See p. 31.)

WATERMELON

Aphids. (See p. 24.)

Spider Mites. (See p. 24.)

Striped Cucumber Beetle. (See p. 25.)

Anthracnose (fungus)

Symptoms and damage.—Round, water-soaked spots on fruits; dark spots on leaves, which may give vines a scorched appearance. At first, spots on fruits are small and raised; later, they enlarge and become sunken; they have dark centers, which may show a pinkish fungus growth in moist weather. Fungus also affects cucumber and muskmelon; it is carried on seed and lives in soil on remains of diseased plants.

Distribution.—Throughout United States.

What to do.—Congo, Fairfax, Charleston Gray, and Blackstone are resistant varieties. Follow seed treatment, spraying, and dusting recommendations for anthracnose on cucumbers (p. 21).

Wilt (fungus)

Symptoms and damage.—Stunted seedlings; wilted vines; reduced yields. Plants eventually die. Wilting starts at tips of runners and slowly spreads to entire vine. Fungus is carried on seed, lives indefinitely in soil, and enters through roots. (Not identical with

bacterial wilt of cucumber and muskmelon.)

Distribution.—In the South and in California; in some Central States.

What to do.—Grow wilt-resistant varieties such as Kleckley No. 6 Im-

proved Stone Mountain No. 5, Fairfax, Charleston Gray, Hawkesbury, Missouri Queen, Miles, Leesburg, Klondike R-7, and Baby Klondike.

Root Knot. (See p. 22.)

BENEFICIAL INSECTS

Certain insects cause no damage and are beneficial to man. They destroy other insects that are injurious to vegetables, and thus are friends of the gardener. Learn to recognize beneficial insects, and avoid destroying them. Following are descriptions of a few of the important beneficial insects.

Ant Lion (doodlebug)

Description.—Rough; sickle-shaped jaws; brown, up to $\frac{1}{2}$ inch long. Lives at bottom of conical pits in sand.

Benefit.—Feeds on ants and other insects. Does not damage plants.

Distribution.—Many parts of United States; most abundant in South.

Aphid Lion

Description.—Adult: Fragile; hair-like antennae; golden eyes; gauzy, green wings. Places eggs singly on stalk. Larvae: Elongate body, tapering at both ends; large, sickle-shaped jaws; prominent, projecting hairs; yellowish, or mottled with red or brown; about $\frac{1}{3}$ inch long.

Benefit.—Larvae feed on aphids, mealybugs, scales, thrips, and mites.

Distribution.—Throughout United States.

Damsel Bugs

Description.—Several species. Resemble assassin bugs; pale gray; about $\frac{3}{8}$ inch long; forelegs used for capturing prey.

Benefit.—Damsel bugs feed on aphids, fleahoppers, and small larvae of insects.

Distribution.—Throughout United States.

Assassin Bugs



BN-14756-X

Description.—Several species. Long legs; light brown, $\frac{1}{2}$ to $\frac{3}{4}$ inch long. These insects walk over plants in a slow, clumsy manner. Their forelegs are usually in a prayerful position, and are used to capture and hold other insects.

Benefit.—Assassin bugs feed on the immature forms of insects.

Distribution.—Throughout United States.

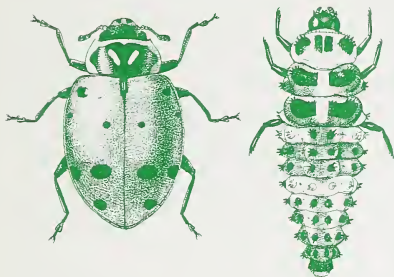
Ground Beetles

Description.—Many species. Adults: Broadly oval, elongate bodies; narrow heads; color usually dull black or brown. Commonly occur on ground surface under stones or loose trash. They hide by day, are active at night, and run rapidly when disturbed. Larvae: Bodies are slender, flattened, and slightly tapering to the tail, which terminates in two spines or bristle-like processes.

Benefit.—Adults and larvae feed on caterpillars and other insects.

Distribution.—Throughout United States.

Lady Beetles



Adult

Larva

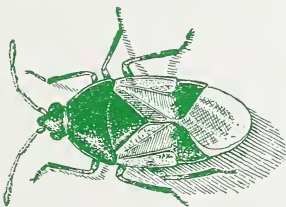
TC-4957

Description.—Many species. Adults: Oval; shiny; red or tan, with or without black spots; about $\frac{1}{5}$ inch long. Larvae: Carrot-shaped; warty; blue, orange, or gray; $\frac{1}{16}$ to $\frac{1}{4}$ inch long.

Benefit.—Feed on aphids, spider mites, scales, and mealybugs. Do not damage plants.

Distribution.—Throughout United States.

Minute Pirate Bugs



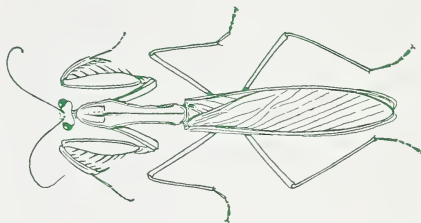
BN-14754-X

Description.—Several species. Adults: Oval, flat; about $\frac{1}{16}$ inch long. Most species are black, marked with white spots or streaks. Nymphs: Similar to adults; amber. Found on flowers and under loose bark.

Benefit.—Adults and larvae feed on small insects such as mites; they also feed on eggs and larvae of many destructive insects.

Distribution.—Throughout United States.

Praying Mantids



BN-14753-X

Description.—About 20 species. Bodies of most species are green; wings are green with brown front margins. Large abdomens, slender thoraxes, wedge-shaped, movable heads. Front legs are large and have spines for grasping prey. Sizes range from $2\frac{1}{2}$ to 5 inches in length.

In fall, females lay eggs in masses on shrubs or tall grasses and cover them with a frothy fluid that hardens. Young mantids hatch in spring; they resemble adults, but lack wings.

Benefit.—Young mantids feed on aphids and other small insects. Older mantids devour many kinds of larger insects that they capture in the garden.

Distribution.—Throughout United States; prevalent in northeastern parts.

Spiders and Mites

Description.—Eight-legged; not insects. Many species. Range in size from the orb-weaving black-and-yellow garden spiders and large hunting spiders that have leg spreads of 2 inches or more to microscopic, predaceous mites $\frac{1}{50}$ inch or less in length. Some spiders have hairy bodies and legs; others have smooth, glistening surfaces; color may be black, brown, yellow and

black, or gray. Color of predaceous mites may be gray or pinkish gray. Some spiders construct webs for snaring their prey; others run or jump to capture their prey.

Benefit.—All spiders and predaceous mites feed by sucking out the body juices of other insects. Large, web-forming spiders attack large flying and crawling insects; small, hunting and jumping spiders attack small insects such as flies, beetles, caterpillars, aphids, and leafhoppers. Predaceous mites are important in the natural destruction of many plant-feeding pests including spider mites, cyclamen mites, aphids, thrips, larvae, and the eggs of many insects.

Distribution.—Many species of spiders and mites occur throughout the United States.

Syrphid Flies

Description.—Many species. Adults: Bright yellow and black; $\frac{1}{4}$ to $\frac{1}{3}$ inch long; hover above flowers and plants. Larvae: Sluglike; brown, gray, or mottled.

Benefit.—Larvae eat insects. Single larva eats aphids at rate of one per minute. Harmless to plants.

Distribution.—Throughout United States.

Wasps



C&F-3869

Description.—Many species of parasitic and predaceous wasps, varying widely in size, color, and general body structure.

Benefit.—Tiny parasitic wasps lay their eggs in the bodies of insects, and the developing larvae kill the pests. Large predaceous wasps—which are well known to every gardener—feed on young caterpillars, which they first paralyze by stinging.

Distribution.—Throughout United States.

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All copies of this publication issued before May 1971 should be destroyed. Editions before that date contained insecticide recommendations that have been discontinued.
